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SELECTED MEDICAL AND SCIENTIFIC STUDIES.

A KEY TO THE PRACTICAL GROUPING OF MENTAL DISEASES.*

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Abstract.

Steps in the logical classification of disease.
The task of the psychiatrist contrasted with the alienist's.
Insanity not an entity; neither are all mental diseases *sui generis*.
Disease-group diagnosis in psychiatry, analogous to botanical classification of "orders."
Ten disease-groups or "orders" plus an eleventh for the residuum of cases.
-osis and *-aceæ; Rosa gallica* and *Neurosyphilis paretica.*
The key principle.
Special discussion of the eleven groups, syphilitic, feeble-minded, epileptic, alcoholic, drug and poison, focal brain (including traumatic and arteriosclerotic), somatic, senescent-senile, dementia præcox, manic-depressive, psychoneurotic and psychopathic.
Conclusions.

Key to the Practical Grouping of Mental Diseases.

The layman makes out in the great majority of cases the gross fact of sickness. The layman works as it were with the naked eye of mere observation. The practitioner soon replaces the gross *"looks sick!"* with the more concrete *"looks surgical," "contagious," "obstetric," "mental," "nervous,"* etc. The general practitioner advances from the unarmed eye of mere observation to the lens-like power of trained comparison. He is termed "general" in that he deals with great groups, classes or orders of diseases. But these great groups fall short of the true aim of diagnosis, — the pragmatic aim of showing what is best to do. These group captions indicate general lines of treatment, corresponding with but the lowest power of the logical microscope. Resort must be had to the specialist, if such exists and is available (or the general practitioner must be his own specialist); in short, a higher power of the logical microscope is invoked and "*surgical,*" "*contagious,*" etc., get resolved into "*abdominal,*" etc., "*exanthemata,*" etc. Finally still higher powers of the logical microscope, "oil-immersion systems," as it were, are applied, and the so-called entities, the latest constituents of the nosology of the day, roll into view. Thus, with the progress from mere observation to comparison and synthesis, "*looks sick*" turns, *e.g.*, into "*mental,*" and "*mental*" turns, *e.g.*, into "*syphilitic,*" and "*syphilitic*" turns, *e.g.*, into "*general paresis.*"

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* Read at the forty-third annual meeting of the American Neurological Association, May 21, 22 and 23, 1917. Reprinted from The Journal of Nervous and Mental Disease, Vol. 47, No. 1, January, 1918.

In the uneven progress of diagnostic science, as roughly marked out by medical-school departments and by the great specialized medical association, the "mental" has not been the most favored of the great groups. Alienists, however, are slowly but surely being replaced with psychiatrists. Alienists are required by the exigencies of legal medicine to make the generic distinction "mental," *i.e.*, "insane," and the more canny of the alienists stop with this distinction. Psychiatrists are those whose duty requires them to go farther and identify groups of mental diseases and the entities themselves. The task of the psychiatrist is super-legal, special, concrete, not legal, general and abstract like that of the alienist. When alienists and psychiatrists are brought into the same courtroom, as in the Thaw case of evil memory, havoc is apt to be played both with legal and with medical distinctions.

In presenting this key to the grouping of mental diseases I want to make clear exactly what stage of classification I am referring to. (1) The layman is supposed to have made his gross observations. (2) The general practitioner is supposed to have placed the case in the great group of the mental. As yet no alienist is supposed to have approached the case, endeavoring to determine "insanity" for the benefit of some court and to satisfy the dictates of some code of lunacy laws. No! the next phase of inquiry is that of (3) the psychiatrist or of the general practitioner specializing as a psychiatrist.

The object of this psychiatric inquiry is, not to determine what would satisfy a court as to committability, but to determine from a physician's point of view what the disease in question is.

The alienist may enter, if he likes or if it is necessary, to determine the medically irrelevant fact of insanity. We shall be even willing to supply the alienist with pertinent records and observations. It is even sometimes true that psychiatrists make reasonably good alienists, just as they may make good hospital superintendents or good laymen. But it must be insisted that the medical problem is distinct from the legal problem, — that the problem of the psychiatrist is not that of the alienist.

The psychiatrist now confronts his "mental" — or, more exactly, his psychopathic — material, freed for the time being of medico-legal (*i.e.,* "committability" or "insanity") considerations. How shall the entity be reached, viz., something to correspond in mental diseases to scarlet fever among the contagious diseases?

The easiest way out, perhaps, is to deny the existence of entities in mental disease. There are two forms of this contention, — first, that mental disease is nothing more nor less than insanity, an entity itself, a genus with but one species; secondly, that all victims of mental disease are individually to be provided with entities, that is, all examples of mental disease are *sui generis.* The development of psychiatry has killed the former contention stone-dead, but the latter contention still flourishes to an extent among those who overstress the "individual factor." And this latter contention is bolstered up by the existence of so many psychopathic patients of whom a diagnosis cannot be rendered for practical or theoretical reasons. However, there are no really consistent advocates of the *sui generis* plan of classification.

Following is my own plan for the analytical consideration of available data in a case of mental disease. I achieve thereby a provisional diagnosis or group-diagnosis which I regard as an important step towards final diagnosis, *i.e.,* diagnosis of the particular group-member or entity. It is hardly necessary to interpolate that if I can achieve the entity by skipping the stage of provisional diagnosis I shall do so cheerfully. This list is not a list merely, but a sequence, a key to be followed, when necessary, like a botanical key in the search for the classification of a plant.

I have stressed the key-principle in the method of grouping adopted, and shall linger a little on the botanical analogues of the key and the ordered group-list. Omitting details (discussed *infra*), the sequence of mental disease-groups I have provisionally arranged as follows: —

Mental Disease Groups (Orders).

1. Syphilitic,	Syphilopsychoses.
2. Feeble-minded,	Hypophrenoses.
3. Epileptic,	Epileptoses.
4. Alcoholic, drug, poison,	Pharmacopsychoses.
5. Focal brain ("organic," arteriosclerotic),	Encephalopsychoses.
6. Bodily disease ("symptomatic"),	Somatopsychoses.
7. Senescent, senile,	Geriopsychoses.
8. Dementia præcox, paraphrenic,	Schizophrenoses.
9. Manic-depressive, cyclothymic,	Cyclothymoses.
10. Hysteric, psycho-, neurasthenic,	Psychoneuroses.
11. Psychopathic, paranoiac, *et al.*,	Psychopathoses.

Disregarding for the moment both the order and the sufficiency of the list let us consider the nature of the terms. The ending *-osis* was chosen for these groups to correspond exactly with the ending *-aceæ* for certain botanical groups, the so-called orders of plants (for simplicity's sake I pursue here only the botanical, not the zoölogical analogy). The parallel can be shown thus: —

Rosaceæ,	order,	Syphilopsychoses.
Rosa,	genus,	Neurosyphilis.
gallica,	species,	paretica.
R. gallica,	name,	N. paretica.
red rose,	common name,	general paresis.

Or: —

Cucurbitaceæ,	order,	Hypophrenoses.
Cucurbita,	genus,	Hypophrenia.
Pepo,	species,	idiotica.
C. pepo,	name,	H. idiotica.
pumpkin,	common name,	idiocy.

Or: —

Rubiaceæ,	order,	Epileptoses.
Coffea,	genus,	Epilepsia.
Arabica,	species,	tarda.
C. arabica,	name,	E. tarda.
coffee,	common name,	late epilepsy.

From this hint it may be seen that the use of the plan does not necessarily contemplate renaming diseases, although this may be often very desirable. It is not that a sufficient diagnosis of a given disease is, *e.g.*, "syphilopsychosis," any more than it would be proper to stop in plant diagnosis with *Ranunculaceæ* when the true goal was *Hydrastis canadensis*.

Whereas the ending *-osis* suitably expresses ordinal characters, the ending *-ia* (as in epilepsia, neurasthenia) suitably indicates generic characters of disease; indeed some dictionaries regard *-ia* as primarily suggesting disease. The ordinal ending here preferred is accordingly *-osis;* the generic ending *-ia*.

So much *re* nomenclature may suffice at this time (see below under the separate groups for further remarks). Aside from certain novelties in nomenclature the plan has, I believe, merit as an application of a key-principle. Even if one were content with ordinary English group names ("syphilitic," "feeble-minded," etc.), still the order of consideration of group-data would remain of commanding importance. Should not a shred remain of the nomenclature just presented, the key-principle in the analysis of clinical psychiatric data would remain of use.

I commend the analysis of clinical psychiatric data upon a key-principle, much as by trial and error in the botanical process of classification. I do not, on the other hand, especially commend the gathering of the data in this order or in any special order. After the data are collected by some impartial process of observation and regular process of recording, I would then proceed to the analysis of the data in the order mentioned. I would give every hypothesis the completest opportunity to verify itself. I would even impress slight symptoms and minor indications into the service of each hypothesis in succession. This artificial bias is perfectly safe, since I am going down the line of possibilities giving the same bias in succession to each. For there is one striking difference between botanical classification and medical diagnosis. In botanical identification (as with Gray's botany) if I reach *Hydrastis canadensis* I hardly need to go farther, so rare are true plant hybrids. But in medicine a man may be victim of several diseases, and one must consider all pertinent possibilities (see below for remarks on "combined psychoses").

The whole matter of quasi botanical and zoölogical classifications in the psychiatric field would gain from a review on modern lines of the older classifications from de Sauvages and Linnæus; but this is not the place for an elaborate review.

Without further introduction I pass to remarks on the eleven groups themselves. I purposely omit consideration of the disease "genera" under these "orders," because there must obviously be so much controversial in most groups; for the data are not all gathered for a proper taxonomy! However, under the syphilitic and feeble-minded groups I have made suggestions for the "generic" subdivision of these "orders."

1. *Syphilopsychoses* (*the Syphilitic Group*). — The main representatives of this group are general paresis (otherwise general paralysis of the insane, paralytic dementia, "softening of the brain") and the so-called "cerebral syphilis," preferably termed cerebro-spinal syphilis. I have recently tried to bring more order into the nomenclature by throwing together all diseases of the nervous system traceable to syphilis under the term neurosyphilis, the main forms of which are (*a*) paretic, (*b*) tabetic, (*c*) diffuse, (*d*) vascular, (*e*) juvenile and (*f*) gummatous. The majority of these forms of neurosyphilis are at one or other period characterized by mental symptoms, so that the six-heading neuropathological classification works well enough for the psychoses more narrowly taken. However, the tabetic psychosis (a variety of *Neurosyphilis tabetica*) is exceedingly rare, so rare that I question my ever having seen an instance. On the other hand, mental disease supervening in tabetics is of course common enough, and will ordinarily turn out to be part and parcel of general paresis (*Neurosyphilis paretica vel taboparetica*), though sometimes the symptoms will prove due to intercurrent syphilitic blood-vessel disease (*Neurosyphilis arteriosclerotica* plus *Neurosyphilis tabetica*). It is clear that examples will be found of *Neurosyphilis diffusa, i.e.*, of a mental disease depending on a widely diffused process, possibly involving meninges, parenchyma and vessels as well, but having a prognosis far more favorable *quoad vitam* than *Neurosyphilis paretica.* Where possible, the diagnosis should certainly seek to pick out the meningeal, parenchymatous and vascular features, or their combinations, and distinguish these factors in the designations chosen. Something like this has been attempted by Head and Fearnsides, although the *syphilis centralis* of these authors seems not too happy a term, permitting the diagnostician to escape without a prognostic comment and without specifying what he really thinks is going on in the "central" substance.*

2. *Hypophrenoses* (*the Feeble-minded Group*). — The main representatives of this group are the well-known graded forms of feeble-mindedness (as we use the term generically in America),

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* For full discussion see Southard and Solomon, "Neurosyphilis: Modern Systematic Diagnosis and Treatment presented in 137 Case Histories" (Monograph Number Two of the Psychopathic Hospital, Boston), Boston, W. M. Leonard, 1917.

viz., (*a*) idiocy, (*b*) imbecility and (*c*) feeble-mindedness proper (the morons of Goddard, collected by Tredgold under the term *morosis,* in point of fact, a term used by Linnæus). The excellent results of modern mental testing, however, have left us with a fourth group of (*a*) subnormals, lying between the morons below and the normals above; these may be known as dullards, simples or stupids (Tredgold), among whom none should be included save those who actually *measure* low by modern scales and gradings. Thus, above (*a*) *Hypophrenia idiotica,* (*b*) *H. imbecilla* and (*c*) *H. morotica* we should find (*d*) *Hypophrenia subnormalis* (*sc. metrica*). But, as practical work abundantly shows, there are other hypophrenoses in which available measurements leave us at loose ends or at a loss. These Tredgold inclines to term *Amoralia* on account of their moral deficiencies and as a condensed term for Prichard's moral insanity (or a part thereof). Perhaps the reference to conventional standards implied in such terms as moral insanity or imbecility, or amoralia, is more or less justifiably resented by modern workers. Moreover, sometimes the deficiency is not in morals and yet exists. "Congenital psychopathic inferiority" is a term which covers many of these cases, being perhaps a rough translation of *Minderwerthigkeit.* "Below par" we sometimes say of these cases, being a figurative usage of the term "par" when no method exists of determining what is par (*Minderwerthigkeit* has the same air of greater exactitude than exists). On the whole perhaps we do less violence to existing terminology if we speak of (*e*) *Hypophrenia amoralis.* I often think of the group as one of non-metric or qualitative feeble-mindedness, though it cannot be denied that "qualitative weakness" is a contradiction in terms. This latter objection would be the stronger if we were trying to describe a scale of intensity in some one attribute. In many instances, it has seemed to me as a psychiatrist, these cases of qualitative inferiority are marked, not so much by a weakening of faculties as by a total absence of various faculties, — faculties, of course, that are not indispensable in life. Without endeavoring to prove or expound the idea, what would happen could the instinct of disgust be conceivably left out of a subject's makeup? One could not then measure it; one could merely find it lacking. High evolutionary complications, *e.g.,* disgust, have simply not entered the subject's make-up. Accordingly, I personally would prefer (*e*) *H. simplex* (*sc. non-metrica, qualitativa*) to *H. amoralis.*

The classification might go —

(*a*) *H. idiotica.*
(*b*) *H. imbecilla.*
(*c*) *H. morotica.*
(*d*) *H. stupida vel subnormalis* (*sc. metrica*).
(*e*) *H.** *simplex vel amoralis* (*sc. non-metrica, qualitativa*).

I may be pardoned a word on behalf of the feeble-minded patients whom we now so often demonstrate in clinics; it has proved of value to use terms which do not possess unfortunate connotations for the minds of these patients. Of course, idiots are not harmed by hearing the term, and the imbeciles not to any extent. It is all very well to call a spade a spade; but if the listener transforms a "spade" into a pile-driver in his own mind, Richard Cabot's warnings about belligerent truth-speaking fall into queer cross-lights. I find it of value to use in clinical demonstrations perfectly exact terms which the patients have no chance to misconstrue. *Hypophrenia morotica, H. subnormalis, H. simplex* are such terms.

As to the term *Hypophrenosis* itself, it has been suggested to me that *Hypopsychosis* would be preferable. Perhaps so. I considered that "phren" had been used by Kræpelin in his proposal of *Oligophrenia* for feeble-mindedness. Oligophrenosis was then the natural group rendering for the "oligophrenias." I could not see that it was well to preserve the connotation "few" in the prefix "oligo-," which erroneously suggests "*few*-mindedness" where inferiority is really in question. But the other half of Kræpelin's suggestion seemed good, in view of the intellectual trend of the Greek term "phren," which closely imitates the intellectual trend of the term "mind." The "psyche" seems somehow broader than the "phren," just as "soul" seems broader than "mind," at least when both are used. Accordingly, hypophrenosis seemed to be the nearest euphonious Greek equivalent of the term "feeble-mindedness," a term which, lying in the midst of the group, has succeeded in dominating the whole.

3. *Epileptoses* (*the Epileptic Group*). — Without here entering the vexed question of the classification of the epilepsies themselves, I will use the heading to call attention to a feature in the usage of the key to classification of which this group forms a part.

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* Or should there be a new genus? *Amoralia Prichardi?*

If a disease be syphilitic, *i.e.*, if syphilis played an essential part in its causation and is the practically most important factor in that causation, then feeble-mindedness, epilepsy, coarse brain disease and the rest remain subordinate. Whether a disease be *Neurosyphilis hypophrenica* (as a rule, of course, *idiotica* or *imbecilla*) or, on the other hand, *Hypophrenia syphilitica* may be a matter of discussion; practically, however, it is my present contention that such cases be placed in the syphilitic group, really because of our bounden therapeutic duties to these cases.

The same holds for the epilepsies, and so down the line. "Syphilitic epilepsy" is a term good from the epileptologist's point of view; from the point of view of the physician and therapeutist in general it is better to classify the case as one of "epileptic syphilis," viz., in our nomenclature, *Neurosyphilis epileptica.*

4. *Pharmacopsychoses* (*Alcohol, Drug and Poison Group*). — This designation (like hypophrenoses for the feeble-minded group) is a novel term, but one of such obvious fitness for a well-recognized group that I can conceive no reason against its adoption, if the group principle itself is deemed worthy.

Without entering the familiar field of the alcoholic psychoses (delirium tremens, alcoholic hallucinosis, jealousy-psychosis, dementia, etc.), and without discussing morphinism, etc., I will take occasion to point out how in the successive consideration of data pointing in a given case to (1) syphilis, (2) feeble-mindedness, (3) epilepsy, (4) alcohol and drugs we are able to collect all the data that would be of commanding value in immediate treatment in special institutions. To be sure, special institutions for neurosyphilis have not so far been established in the world, though there is much to be said for the plan.* But aside from neurosyphilis or "salvarsan" hospitals, advanced communities will always be found providing special institutions for the feeble-minded and the epileptic. It is an established principle of mental hygiene that the feeble-minded and the epileptic shall be treated separately. Placing a case among the hypophrenias or the epilepsias means, as a rule, something wholly practical; it means that special institutional treatment is indicated (*e.g.*, in Massachusetts, "this is a Waverley case" or "this is a Monson case;" in New York, "this is a case for Rome" or "for Sonyea"); or, if the actual State institution is contra-indicated, then something equivalent or better along the same line is prescribed. As to the pharmacopsychoses, very few States have proceeded to the experiment of special institutions, though Massachusetts, for example, contains a successful one for moral and physical uplift cases. The "rounder" group and the delirium tremens problem are, so far as I am aware, not adequately dealt with on the planet. Not to launch into a homily on mental hygiene, let me merely insist that by considering, eliminating or appreciating the data of these four groups we have dealt with some of the largest social problems in psychiatry. How often in the elaborate discussion of doubtful mental cases do we find our younger officers indulging in long, not to say acrimonious, discussions of the relative merits of dementia præcox and manic-depressive psychosis, only to learn at the end that the case was essentially syphilitic, feeble-minded, epileptic or alcoholic! And how often do we hear circular controversies about the respective parts played by epilepsy and alcohol, or by alcohol and dementia præcox in certain cases! The practical diagnosis is brought out at once, as a rule, by the simple inquiry, "Do you desire this case *treated* as an epileptic primarily, or primarily as an alcoholic?" or, "Do you fancy this case in a hospital for dipsomaniacs or do you want him placed in a hospital for the insane?" It is especially in this group of pharmacopsychoses that these pragmatic questions acquire their greatest significance.

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* The Massachusetts Commission on Mental Diseases and the Grafton State Hospital Board have co-operated in the establishment of a neurosyphilis ward, operated by special investigators.

5. *Encephalopsychoses (the Focal Brain Group, including Arteriosclerotic, Tumor, Traumatic Cases, etc.).* — This is the "neurologist's group" of mental diseases. The classification is of course not as broad as that of nervous diseases as a whole, because there are still many nervous diseases without a characteristic psychotic side. Still, in general, the neurologist's technique in virtually its entirety is required in the elucidation of the encephalopsychoses. The neurologist is of value elsewhere, notably in the syphilitic group, precisely because many of the syphilopsychoses are attended by coarse brain disease or by spinal cord disease deranging brain functions. Here, then, is the group in which the condition of the reflexes, the sensations, the motor and secretory powers, as determined by the neurologist, is of decisive worth in diagnosis.

The practical worker may be astonished at one feature of this group, seemingly so heterogeneous. It is the habit — a lax one, I believe — of many workers to unite in their minds too closely the arteriosclerotic and the senile psychoses. I place the arteriosclerotic cases in the encephalic (focal brain) group, because I believe that in the present phase of psychiatric science the diagnosis "arteriosclerotic psychosis" cannot be safely made except in the presence of some of the neurologist's signs, or supported by shocks or other seizures in the anamnesis. I do not here speak of the mental sequelæ of somatic arteriosclerosis or of generalized arteriosclerosis; the arteriosclerotic subgroup of the encephalopsychoses is a group, according to this interpretation, of which "organic neurological" symptoms, signs and history are characteristic. Some may miss the opportunity of ascribing "general deterioration" to arteriosclerosis; the present key requires investigation to learn whether the disease in question is assumed to be due to focal brain vascular lesions (encephalopsychoses) or to senility (see below, geriopsychoses) or to generalized arteriosclerosis (somatopsychoses, cardiovascular group) or, of course, to syphilis itself.

I would maintain a somewhat similar practical value for this key in the traumatic field. How many protracted, nay, meaningless, medicolegal discussions could have been dispensed with could the question, *whether the trauma was encephalic structural injury or not*, have been settled forthwith! A case for the present key is placed in the encephalopsychoses, traumatic subgroup, if there is good neurologist's evidence of some sort of focal brain disease; but it is placed far away in the group of the psychoneuroses if it has features predominant of the so-called traumatic neuroses. (It may be superfluous to say that this key does not infallibly place a case in the *right* major group.)

It is only fair to ask whether a line can be drawn between "focal" and "not-focal" brain disease. For instance, sometimes a case with multiple miliary aneurysms of the brain substance comes up for discussion. To be sure, such a case is commonly attended with multiple hemorrhages which would serve to place it forthwith in the focal brain disease-group. Nevertheless, many of the nervous and mental symptoms are doubtless due to lesions that could hardly be seen by the naked eye. The point is not so much what "coarse" lesions are demonstrable post mortem, as it is whether the neurologist with his special logical equipment can make the diagnosis. Or, again, take the brain lesions of certain cases of pernicious anemia. Shall these cases be placed among the encephalopsychoses? The brain lesions are microscopic. But on the criterion of the encephalopsychoses as the neurologist's group, I am inclined to say that these cases should be counted amongst the encephalopsychoses. I believe I should also desire to place the rare Alzheimer's disease here also, on the ground of its "organic," not senile, appearance.

The plot obviously thickens hereabouts. Miliary aneurysms and Alzheimer's focal lesions, however largely invisible to the naked eye, are nevertheless lesions which cut mechanisms apart precisely as larger lesions cut them apart. The lesions are, as it were, globar or molar lesions, and not of the diffuse and intimate character of those in many diseases. With the pernicious-anemia brain one is not so dogmatic. Perhaps, if we knew the somatic origin of pernicious anemia, we should prefer to classify this condition among the somatic psychoses. As for pellagra, I should prefer to place its psychosis in the next group.

6. *Somatopsychoses (the Bodily Disease Group, including Infective and Exhaustive Cases, Cardiac Cases, etc.).* — This is the "internist's group" of mental cases.

The term "soma" is sometimes opposed to "psyche," sometimes to "head," sometimes to "brain." The hylozoist might oppose this term on the ground that all mental diseases are "somatic." An ardent dynamicist might query whether any mental disease is importantly "somatic." An interactionist might object on both grounds.

I am here innocently trying to oppose the term to the "brain" or "encephalon." After eliminating (1) syphilis, (2) feeblemindedness, (3) epilepsy, (4) alcohol and drugs, (5) the "organic neurological" conditions, I then turn to (6) the organic nonnervous field. I apply the internist's technique. I perhaps find some "symptomatic psychoses" that appear to be intimately dependent upon cardiac or renal conditions; or again, upon infectious disease, such as typhoid fever or pneumonia; or again, upon non-nervous tumor, diabetes, metabolic disease, etc. As above mentioned, it would seem well to consider the possibility of pellagra at this point, perhaps also pernicious anemia (provisionally, however, placed among the encephalopsychoses so far as its mental side is concerned).

There, too, may be placed the glandular affections, — hyperthyroidism, myxœdema, cretinism and the like.

7. *Geriopsychoses* (the Senescent-senile Group).* — Both the name and the key-position of the senescent-senile group may perhaps be questioned. As to the key-position, it might be

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* Better, *Presbyopsychoses?*

queried whether it would not be better to exclude dementia præcox and manic-depressive psychosis before invoking involutional processes to explain a given mental disease. Still, in the use of this key, one is not supposed to stop with the first plausible group into which the clinical picture might fit. Accordingly, one would be assumed not to omit a study of the data from these other points of view.

I was moved to place the old-age group seventh, partly to range it with more definitely organic psychoses, and partly because I felt it better not to divide the succession that follows (see groups 8, 9 and 10).

"Geriatrics" is a term that is very properly coming in to cover a definite but ill-developed specialty dealing with old-age disorders. I want to use "geriopsychoses" to cover, not merely the pronounced and ultimate disorders of old age, but the disorders of senescence, the presenium and the involution period. It is, at any rate, practically important to consider all the data together that look in this direction, along the down gradient.

As above stated, I feel that it is practically important to separate the arteriosclerotic group from the senescent-senile. Not that arteriosclerosis is not a frequent phenomenon in old age (as it is assuredly also often not a marked factor). One may truly be as old as one's arteries, but the arteries are not always as old as many other parts of the body. Aside from all discussion as to what constitutes old age, the prognosis of arteriosclerotic psychosis is often quite other than that of senile dementia with which it is so frequently confused. Accordingly, I believe that practical psychiatrists will agree that it is a practical advantage to consider the signs of arteriosclerotic psychoses separately from those of the senescent-senile group.

8. *Schizophrenoses (the Dementia Præcox or Schizophrenic Group).* — As "dementia præcox" forms no proper adjectives, the choice by Bleuler of the term "schizophrenia" for dementia præcox has been welcomed on all hands. Kræpelin himself, although he still speaks of the disease dementia præcox, often uses the adjective schizophrenic for the victims of the disease.

The idea of schizophrenia, viz., "dissociation" or "splitting" of mental processes, lies at the bottom of much, if not all, that is distinctive of the mental-symptomatic side of dementia præcox.

There is therefore a good deal to say for building a group-designation of schizophrenia, the symptom. Kræpelin, to be sure, in his last edition groups dementia præcox and paraphrenia (a renamed French disease, *délire chronique à evolution systematisée*) under the general term "endogenous deteriorations." But this term "endogenous deteriorations" seems far too general, besides which "endogenous" is a term which Germans (following Moebius) have specialized to mean "taking rise within the nervous system," a meaning possibly warranted, but certainly not generally accepted.

Of course, practical workers are apt to use "dementia præcox" for disease which, though functional looking, is regarded as fated to deterioration. Although everybody is theoretically aware that not all cases of dementia præcox deteriorate, yet the "lure of the 100 per cent." and the catchiness of the term "dementia" lead to a practical disregard of the actual guarded prognosis of dementia præcox and a virtual claim that all "real" cases of dementia præcox deteriorate. One is familiar with clinics in which the diagnosis of functional-looking diseases is from time to time revised in favor of dementia præcox if deterioration has set in, and in favor of manic-depressive psychosis if there has been no deterioration. The fact that Kræpelin observed that dementia præcox patients are apt to deteriorate *in particular and characteristic ways* is revised by practical men to the effect that dementia præcox deteriorates, and, if not, the diagnosis is wrong.

In a clinic for doubtful cases, like that of the Psychopathic Hospital in Boston, I find that the diagnoses tend to vary somewhat with the natural pessimism or optimism of the workers. I find it practically of value to limit the diagnosis dementia præcox to cases in which something schizophrenic can be found. We may thus score too low a tally of correct diagnoses of dementia præcox, but I am sure we save some cases from an unjustifiably pessimistic diagnosis, for at best the prognosis of the schizophrenias is not a good one.

9. *Cyclothymoses* (*Manic-depressive Group*). — Just as "dementia præcox" forms no proper adjective, so we find the same difficulty with "manic-depressive psychosis." No one has ever been satisfied with the term "manic-depressive psychosis," although the Kræpelinian conception of the disease which goes by that name has been pretty generally accepted.

The term cyclothymia has been used by some authors for all or part of the disease-group known as manic-depressive psychosis. The cyclic nature of the course of many if not the majority of instances of this psychosis is embodied in the first part, cyclo-, of the term "cyclothymia." The most prominent feature, psychologically speaking, of manic-depressive psychosis is the emotional disorder, which is demonstrated either in the morbid gaiety, fear, anger or depression which characterizes different phases of the disease. Even those complex examples of the disease in which mania and depression occur mixed (cases, as one might say, of "mixed emotions") are still fundamentally examples of emotional rather than intellectual disorder.

Some authors have applied the term "affective" to the group which may be known as the group of the affective psychoses.

The second theme, thym, of the term "cyclothymia" refers to this predominantly emotional or affective nucleus of the disease or diseases known as manic-depressive psychosis. Kræpelin himself occasionally uses the term cyclothymic. Accordingly, I have felt that if we desire to place in a single great group the varieties of manic-depressive psychosis and allied diseases we could do no better than to speak of them as the cyclothymias, or, adopting the common Greek ending for these groups, the cyclothymoses.

It will be noted that the schizophrenias have been placed in this key prior to the cyclothymias. Practical workers will all recognize how easy it is to find "cyclothymic" (that is, "manic-depressive") phenomena in all sorts of mental diseases and conditions which are not genuinely manic-depressive. These cyclothymic symptoms are even not infrequently found in schizophrenic cases. In diagnostic discussions where numerous physicians are consulting, not infrequently one physician is found triumphantly proclaiming dementia præcox on the basis of schizophrenic symptoms, whereas his colleague with equal triumph claims manic-depressive psychosis on the basis of cyclothymic symptoms.

The point of the group arrangement in this key is perhaps nowhere more clearly shown than in the priority that the schizophrenias take as against the cyclothymias. In practice it seems that schizophrenic phenomena blanket cyclothymic phenomena. A victim of dementia præcox may in several parts of his mental life exhibit perfectly good and clear-cut cyclothymic phenomena, yet it is the schizophrenic or dissociation phenomena which, according to this point of view, must command the diagnosis. This situation can the more readily be understood when it is remembered that, after all, the majority of the manic-depressive or cyclothymic phenomena are merely exaggerations or diminutions of normal functions. After all, there is nothing "queer" or dissociative, nothing that definitely proves mental disease in the supernormal gaiety or exaggerated depression of a manic-depressive subject. Perfectly normal subjects may at times show these features, though perhaps not to the extreme extent nor in the rich display that characterizes the manic-depressive patient.

The victim of dementia præcox, according to our point of view as above expressed, must have something in his status or history to show schizophrenia; but elsewhere in his status or history he may very well show those variations above and below the normal in emotions which normal people, as well as manic-depressives and other psychopaths, show. In short, the cyclothymic patient shows variations of emotion which are decidedly within the frame of the normal, and can rather readily be understood by the layman.

The manic-depressive is either supernormal or subnormal in his emotional display at a given time, and so far as the layman can tell is often doing only what a normal person might do under the circumstances. The concept of schizophrenia, on the other hand, is not one which the layman readily grasps; it is, in fact, fundamentally hard to define.

10. *Psychoneuroses* (*the Group of Neurasthenia, Psychasthenia and Hysteria*). — It may seem that the psychoneuroses should not be grouped among mental diseases. One suspects, however, that the authority who takes this line is under the influence of older notions as to the supposed identity of mental disease with certifiable insanity.

From the standpoint of general practice, or of clinic which lies nearest to general practice, namely, the psychopathic hospital clinic, the psychoneuroses are precisely as much within the frame of psychiatry as the schizophrenias and cyclothymias.

As far as the gravity of these conditions is concerned, there is not much doubt that many of the psychoneuroses are just as grave in prognosis as many of the cyclothymias. It may be suspected that some of the cyclothymias are in practice termed psychoneuroses precisely because the diagnostician fears that the patient and his friends will resent the diagnosis manic-depressive psychosis, when the diagnosis neurasthenia or psychasthenia will not be resented or feared.

It cannot be denied, however, that the demarcation of the psychoneuroses is an extremely important one from the practical standpoint of prognosis. Whereas the schizophrenic group takes its own way, and whereas the cyclothymic diseases seem in a sense self-limited, or at all events beyond the reach of special therapeutics, on the other hand the psychoneurotic group is the psychotherapeutic group par excellence. We practically mean when we call a case psychoneurotic that we feel that the case has a good chance under methods of direct or indirect psychotherapy.

It might be inquired whether the psychoneuroses should not be placed nearer the head of our key. Errors in diagnosis are undoubtedly found in which some other form of mental disease is asserted to exist when psychoneurosis is the fact. However, we have come upon so many instances in which syphilis, alcoholism, arteriosclerotic brain disease, somatic disease and manic-depressive psychosis have been erroneously regarded as psychoneurotic that I feel confident that these conditions should be considered and eliminated prior to making the diagnosis of neurasthenia, psychasthenia or hysteria. Of course, if a wrong diagnosis of some other form of mental disease is rendered, then it is conceivable that the psychoneurotic patient will fail to get what he so importantly needs, namely, psychotherapy. However, the will to psychotherapy is so deeply implanted in every physician that I feel few cases have genuinely suffered from the lack of an attempt to carry out psychotherapy. Of course, no one would claim that every psychoneurotic gets the proper kind of psychotherapy or enough of it; but that is another story.

11. *Psychopathoses* (*the Group of the Psychopathias and of a Variety of Doubtful Entities*). — I shall not here discuss at length this doubtful group. I place therein a variety of ill-defined conditions. Some of these, as the psychopathic personalities, verge very closely upon the normal; others, like the so-called prison-psychoses, are considered by some authorities not to exist at all, at least as entities.

The true nature of the so-called "psychosis of the deaf" is not well enough understood to permit its characterization; at all events, it does not appear to fall among the ten well-defined groups listed above.

Those rare cases of true paranoia I personally prefer to place in this ill-defined group of psychopathoses. At any rate, I see no special advantage in making these pure paranoias, without signs of mental dissociation or tendency to deterioration, tag along behind the schizophrenias.

I would also place in this ill-defined group those rare cases of mental disease which are regarded as certifiable and deserving of institutional régime, but which cannot be practically classified in any one of the above-mentioned ten groups.

Of course, in practice these "undiagnosticated insanities" are really the fruit, as a rule, of poor observation or of poor opportunity for observation.

At this point it may be inquired whether such entities as combined psychoses need be assumed. For my part, I am wholly willing to agree that a patient might properly enough be theoretically placed in any one of several of the groups above mentioned. Thus a patient might well be an old man with coarse brain disease and disease elsewhere in his soma who had acquired syphilis, was extremely alcoholic and had been a feeble-minded subject to start with; and this subject might, of course, have shown a variety of psychoneurotic and cyclothymic symptoms. It is even possible that such a patient might exhibit some phenomena that looked like those of a dementia præcox. Practically, however, such a case would be placed in one of the above-mentioned ten groups precisely because the diagnostician would want to have the case treated primarily either as a syphilitic or as a feeble-minded subject or as an epileptic, etc. Accordingly, we may provide full scope for the so-called combination of psychoses in theory without damaging the practical validity of the above-mentioned classification.

Summary and Conclusions.

I have here presented not so much a classification as a key to the grouping of mental diseases. The key has been worked out to the extent of ten well-defined groups and an eleventh residual group. These groups correspond to the groups of, *e.g.*, the *Rosacœ* or *Leguminosœ* of botany, and do not correspond to the genera and species of those orders. Some hint is given of the generic and specific distinctions of mental disease that might correspond to the genera and species of botany, provided that there were any practical need for a quasi-botanical or zoölogical genus-species distinction in mental diseases.

The incentive to this grouping has been practical. No endeavor was made on the library table to construct a *hortus siccus* of mental diseases. On the contrary, this key is the product of several years of work in the Psychopathic Hospital in Boston, where the task of reasonably accurate diagnosis by an ever-changing staff of psychiatrists-in-training was the desideratum.

I do not accordingly suggest this key as something to replace the methods of the expert in arriving at a conclusion concerning psychiatric diagnosis. I do offer it, however, as a guide for the tyro and the psychiatrist-in-training. It is not an outline giving an order of examination. It is a scheme for summarizing and evaluating results after the physical, mental and historical data are collected. The plan is eliminative, but is subject to this reservation, — if one arrives in the chosen sequence of analysis at a plausible or even a correct group diagnosis one is not thereby absolved from continuing the process of analysis. All data bearing on any of the groups must be considered. Diseases may be "hybrid," though practically one is almost never in doubt as to the group under which to subsume a case. Theoretically, one may be, for example, both epileptic and alcoholic; practically one is either an epileptic alcoholic or an alcoholic epileptic. The guide to the grouping here is a pragmatic one, and depends upon the institution or the special treatment to which the supposed victim of epilepsy and alcoholism must gravitate. I must especially emphasize that the groups and the group names do not correspond to nosological entities and entity names. The placing of a case in one of these eleven groups is not psychiatric diagnosis in the entitative sense. Accordingly, this grouping does not run into collision with any previous endeavor to classify the genera and species of mental disease, such, for example, as the genera and species in the majority of classifications quoted in Hosack.[1]

I would insist, further, that the group headings given are not special enough to constitute sufficient diagnosis for a classification of use in the statistics of institutions for the insane. The plan is not so much an excursion in nosology as an essay in the technique of psychiatric diagnosis for the tyro. The plan gives hints for a method of arriving at an eventual diagnosis; it does not prescribe the names of diseases. Again, the plan is not an etiological plan, although recent advances in psychiatric etiology have been such that many of the practical groups are actually etiological groups.

It is possible that the sequence has been unduly telescoped. It is possible that there should be a traumatic and an arteriosclerotic group. I have placed both of these groups in the encephalopathic or coarse brain, or "neurologist's" group, feeling that I do the diagnostic tyro a service by pulling the encephalotraumatic psychoses far apart from the traumatic psychoneuroses on the one hand, and the arteriosclerotic psychoses far apart from the senile psychoses on the other hand.

Lastly, I would insist once more that the plan is one born of Psychopathic Hospital experience and bred in the first place for the inexpert. It is a key to study and not an analytical classification with any pretense to finality. Elements in the sequence can be destroyed and new elements inserted. Indeed, such processes of extrapolation and interpolation must needs occur in the progress of practical diagnosis. Whatever novelty the plan may have lodges in the sequential character of the analysis of data already collected, and not in the completeness or ultimacy of the groups. The sequential plan of analysis is of course as old as the diagnostic hills. It is superior, however, to the type-matching method of diagnosis in vogue with many tyros, who very often come to their superiors with the plaint that the data in a given case fit the book descriptions of half a dozen diseases. A set sequential analysis of collected data must be superior to a hit-or-miss type-matching of entities.

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1. Hosack, David: "A System of Practical Nosology: to which is prefixed A Synopsis of the Systems of Sauvages, Linnæus, Vogel, Sagar, Macbride, Cullen, Darwin, Crichton, Pinel, Parr, Swediaur, Young, and Good, with References to the Best Authors on each Disease," 1st edition, 1819, 2d edition, 1821, New York.

SOCIAL WORK AS WAR SERVICE.

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Every woman to-day must be asking herself what part she is to take in the war. Exempt from draft, women have a stronger moral obligation to find their proper places, to volunteer where they are needed, or to prepare themselves to volunteer where they will be needed. The greatest burdens of the war will probably not be upon this country for a year or two years, so that there is an amazing opportunity for a woman to fit herself for some kind of work that the world will need. Great as the demand for skilled workers of all kinds is now, there will be a still greater demand a year later, and the interval may serve for acquiring skill in some branch of work that must inevitably be in demand. Insistence upon trained work is the keynote of our national war program.

In social work the scarcity of trained workers is appalling. Our social organizations are now undermanned, and positions are being created faster than workers are being trained. The Intercollegiate Bureau of Occupations states that "for many months there has been a much larger number of positions registered than could be filled." The organizations meanwhile are finding that it is better not to attempt some kinds of work than to employ unqualified persons. This situation is not realized by the disinterested public. The common idea of social work is that it means being kind and helpful to the distressed, a sort of enlargement of the friendly services that all sympathetic and intelligent persons extend to their neighbors; and therefore it is supposed that kind and sensible persons will always be available in large numbers for any social work there is to be done. The public has not yet grasped the fact that social work has become an organized branch of professional activity requiring workers with special qualifications and a definite training, which is offered in professional schools and in graduate departments of universities.

In connection with the war there must inevitably be a demand for social workers that will overwhelm an already inadequate supply. Trained workers will be required for civilian relief; recreational activities in connection with camps; and after-care of soldiers physically or mentally disabled, — blind, deaf, crippled or suffering from nervous disorders. To meet this demand a large corps of women should be under training during the coming year. Approximately full time for a year is the minimum time for preparation for responsible positions. Short courses in stenography, telegraphy, or attendant nursing may seem more alluring. Short courses are being offered in various places to train social workers' aides, and are of value, but should not be confused with the thorough training of the professional social worker. The Canadian Patriotic Fund in Montreal has been remarkably successful in employing untrained volunteer workers, having 700 engaged at one time; yet Miss Reid, director of the Women's Auxiliary, after paying enthusiastic tribute to the spirit and accomplishment of these volunteers, says, "With the numerous opportunities for volunteers in the United States to prepare themselves now under trained workers, many of the problems resulting from inexperience and assuming threatening proportions at times in the Montreal staff should not arise in the course of your work." *

Until recently social work has not attracted college women to any great extent. The social worker is frequently asked by her able-minded friends, "Why do you think it is worth while?" "Do you get anywhere?" "What does it amount to, pulling some people out of trouble while others are falling in?" On the other hand, her more emotional friends will say, "How happy you must be, doing so much good!" "What a wonderful thing it must be to be able to help people!" Both of these points of view have at last met in social work, presumably to become in time firmly bound together in a science whose practice is an art. The fact that as a science social work is in the earliest stages of development will be an incentive to many to take part in its advancement. The literature of social work is scanty, and deals largely with special activities. The philosophy underlying the great aggregation of activities that are generally known under the term "social work" has not yet been presented in any single volume. It is difficult for any one who seeks to know exactly what social work as a profession means, to find out. Observation leads to a bewildering number of contradictions; the literature is confusing and not stimulating to the imagination; the social workers you may talk with are apt to be absorbed in their special job and unready to philosophize. The best hope of under-

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* "War Relief in Canada," by Helen R. Y. Reid, Director and Convener, Ladies' Auxiliary of the Canadian Patriotic Fund, Montreal. Address before the National Conference of Social Work, 1917.

standing the significance of social work is to look about at the signs of the times, — the rapid spread of social service in hospitals throughout the country in the last ten years, the growth of probation systems, the development of parole departments in prisons, the increase in the number of factory welfare workers, the demand for school visitors, the progress of the school center movement. This is the day of individualization, and wherever the problem of relating the individual successfully to his environment arises, there the social worker is needed. As the conditions of the environment improve, it may be expected that the number of individuals requiring assistance in adjustment will decrease; but who can look ahead so far as to see the time when all individuals will be born with normal capacity into a normal environment? Even so the chances of accident would remain, so that the objection often heard, "If society were what it should be we should not need social workers," is a thoughtless misconception. Perhaps the most significant of the signs of the times is the rapid growth of instruction in social work in colleges, both in graduate and undergraduate courses, and the establishment of professional schools for training social workers. A list of the best known of these is appended. A statement such as is made by Dr. E. E. Southard, director of the Psychopathic Hospital, in a talk before the Radcliffe Union, on "Training for Social Work," will still cause astonishment to many whose conception of social work has not advanced with the times, but will indicate to others the certain trend of its development: —

> I would then advocate for prospective social workers a bachelor's degree (with possibly a master's degree in applied work), and I would advocate a social service group of courses involving both scientific and practical aspects of social service with sufficient emphasis upon the statistical side, with proper attention to the facts of economics and sociology as they now stand, but with tremendously greater emphasis upon the psychology of the instincts, the emotions and the will. I should like every practical social worker to be cognizant of language difficulties, if not in command of a speaking knowledge of some other language than his or her own. This problem deserves to be taken with great seriousness. I believe that the social service group of interests is at least as important as the natural science group and the literary or humanities group.

The field of social work may be considered in three main divisions, — work with the individual, community work and research. An example of the last is the Federal Children's Bureau, which employs a number of skilled investigators to collect social data for educational and legislative purposes. Community work includes all social movements that deal with people in groups or masses. Work with the individual, or social case work, as it is usually called, is the division of social work in which the biggest and most immediate demand will be created by the war, through the need of care for convalescent and disabled soldiers and of assistance to the dependent families of enlisted men.

Social case work has methods and principles which can be learned only by its practice. Its object is to restore socially disordered individuals as nearly as possible to normal life. This requires first a study of the individual, and next the organization of all factors in his life, both within himself and in his environment, to effect as complete an adjustment as is possible of that individual to society. This process is fundamentally the same whether we are dealing with a dependent child, a deserted wife, a delinquent girl, a tubercular patient, a psychopathic patient or a crippled soldier. In each case you are dealing not only with the original client, but also with his family, and in each family group you may find any one of the other types. The type of case you specialize in will predominate, but all types will appear. In the eight months' course of study and practice in psychiatric social work that we offer at the Psychopathic Hospital we believe that the student gets experience that prepares her for any form of social case work in addition to special knowledge of mental disease. All branches of social case work deal with psychopathic individuals, recognized or unrecognized as such. On the other hand, the patients of a psychopathic hospital are subject to the same social disorders that the clients of other agencies are. The elements of training should be the same for all case work. The great need is for workers disciplined in the methods and principles that have so far been developed. One valuable book, which appeared this year, is available on this subject.[1] No large body of experience has yet been systematized, and it is still common to hear that a mature able woman will be as successful as the trained worker. But any supervisor of case work will tell you that there is a distinct and important difference between the work of an inexperienced person of ability and an equally able person with training. The popular idea that case work was merely a matter of common sense and intuition has no doubt been responsible for a sentiment, just beginning to evaporate, that case work was a rather inferior part of social work. A social worker until recently was supposed to be "advanced" from case work to an executive or research position. It is now becoming recognized that the study of an individual out of adjustment with his environment and the organization of his life to effect normal adjustment may be a science fit to engage all the powers of mind and personality that a man or woman can bring to it.

Colleges and Special Schools that offer Courses in Social Work.

The New York School of Philanthropy, United Charities Building, 105 East 22d Street, New York City.
Chicago School of Civics and Philanthropy, 2559 South Michigan Avenue, Chicago, Ill.
Boston School of Social Work, 18 Somerset Street, Boston, Mass.
Pennsylvania School for Social Service, 425 South 15th Street, Philadelphia, Pa.
St. Louis School of Social Economy, 221 Locust Street, St. Louis, Mo.
Carola Woerishoffer Graduate Department of Social Economy and Social Research, Bryn Mawr College, Bryn Mawr, Pa.
Department of Social Work, Indiana University, Indianapolis, Ind.
School of Applied Social Sciences, Western Reserve University, Cleveland, Ohio.
Toronto Training School, University of Toronto, Ontario, Can.
Richmond School of Social Economy, Richmond, Va.
Margaret Morrison Carnegie School, Pittsburg, Pa.
New Orleans School for Social Workers, 1202 Annunciation Street, New Orleans, La.
Jewish School for Communal Work, 356 Second Avenue, New York City.
Social Service and Nurses' Training School of Georgia, 23 East Cain Street, Atlanta, Ga.

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THE FAMILY OF THE NEUROSYPHILITIC.*

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It may seem trite to call attention to the problem offered by the family of the syphilitic, as it is recognized by all that syphilis is a contagious disease and that in consequence it is frequently transmitted by the infected person to the spouse and to the children. In spite of this knowledge, however, the problem is largely neglected.

The complete story of syphilis and its ravages cannot be told in a limited space. Suffice it to say that the symptoms of syphilis may occur at any time after the infection, even though an individual live a half century, and that syphilis imitates in its symptoms almost every disease. Some of the most frequent and most serious of the syphilitic conditions are cardio-vascular disease, *i.e.*, *early* arteriosclerosis, apoplexy aneurysm, angina pectoris, etc., and diseases of the nervous system, such as general paresis, locomotor ataxia, cerebrospinal syphilis. The latter conditions, due to syphilitic involvement of the central nervous system, are what we include under the term neurosyphilis. General paresis and locomotor ataxia (tabes dorsalis) are always and without exception syphilitic manifestations. Just as without the tubercle bacillus there can be no tuberculosis, so without the spirocheta pallida (the germ of syphilis) there can be no paresis or tabes.

We cannot here consider the mental, physical and moral devastations, the economic and social wastage, the anguish and suffering caused by syphilis in those who have acquired it in adolescent or adult life after nature's defences have been broken down. Nor can we do more than merely enumerate a few of the terrible consequences passed on to the progeny of the infected. Sterility, abortions, miscarriages, stillbirths and early deaths are among the less terrible consequences of parental syphilis; these potential lives escape the suffering and handicaps of many who are born with congenital syphilis. Feeble-mindedness, deafness, blindness, paralysis, deficient development, marasmus, meningitis and skin diseases are among the early manifestations of congenital infection. Many congenital syphilitics are afflicted only with lessened vitality, anemia, delayed development, irritability, nervousness, neurotic manifestations and the like. Others are apparently healthy, well-endowed children, but during the pubescent and adolescent periods the presence of the disease first makes its appearance, frequently as interstitial keratitis, leading to partial or total blindness, or deafness; or there may appear the symptoms of syphilis of the central nervous system, known as juvenile paresis, juvenile tabes, etc., running through the whole gamut of the conditions produced by acquired syphilis. Many more conditions resulting from congenital syphilis might be added as well as the suspicion that many cases of neurasthenia, hysteria and dementia præcox may be of like cause; but enough has been said to indicate the ravages of the disease.

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* Read at the National Conference of Social Work, Pittsburg, 1917. Reprinted from Mental Hygiene, Vol. II, No. 1, January, 1918.

How is it possible that such conditions are allowed to continue almost without challenge? The reasons are several. The greatest of them is ignorance upon the subject, not only of the uneducated public, not only of the semi-informed social worker, but also a considerable degree of ignorance on the part of many physicians. This is not an arraignment of physicians; it is only a frank acknowledgment that our information is but slowly accumulating, and is still almost entirely in the hands of the specialist. To any one suffering from syphilis, let us boldly offer the advice that none should be discouraged if his physician disagrees with what is here stated; consult a specialist in syphilis and he will bear out these observations. We can hardly pause to recall the difficulty of lay education on this previously prohibited topic and the physician's hesitancy of betraying in any way the confidence of his syphilitic patient, even to protect another.

But there are other factors to be considered which depend on the very nature of syphilis. After the early symptoms, for a long period of time there may be no evidence to the patient that the disease is active, and hence he thinks he is safe. Even though warned by a physician he may disbelieve and marry; or the physician may believe him cured and give consent to marriage; or he may ask no advice; or the future spouse may know and not object to marriage on this trivial score; or the victim of the disease may be ignorant of the fact that he has or had acquired syphilis.

At any rate, as we well know, marriage is entered into by many syphilitics, and then arises the problem of the family of the syphilitic. This problem as previously stated is well recognized by all engaged in the study of syphilis. The family of the syphilitic, including spouse and children, has been exposed to syphilis, the spouse exposed to the so-called acquired form, the children to the congenital form. Not all exposed to syphilis acquire the disease — far from it, for at least 75 per cent. of all prostitutes have syphilis, and if it were universally infective it would be almost universally widespread. There are certain laws that give us some insight into the infectivity of syphilis; for instance, it becomes less contagious as time goes on, and open lesions are usually necessary for its transmission. In the congenital form the ravages grow less as the time from the original parental infection increases. These laws can be found in text-books on syphilis, both medical and for the layman.[1] But these laws are based on statistics, and while they apply to a group of cases, any particular case under consideration may prove an exception. In other words, there are many exceptions and much that we do not understand, so that every case presents a special problem.

Syphilis in both its acquired and congenital forms is not always easy to recognize. A characteristic of syphilis is that there are long periods of quiescence or latency lasting months and years, during which there are no symptoms that bother the patient or appear on superficial examination. Then five, ten, fifteen, twenty or even forty years of latency is broken by an exacerbation or a cropping out of symptoms, — symptoms perhaps easily recognized as syphilitic, but recognized often too late for treatment. In other words, latency may only mean the absence of manifest symptoms, while the disease is actively at work in destroying the organism. This period of latency is to be found in nearly every case in which the most serious results occur. Many individuals are not aware that they have acquired syphilis until these late manifestations appear. We have often had patients relate how lucky they had been in avoiding syphilis all their lives, when as a matter of fact they were victims of the disease.

It is during these years of apparent latency that much can be done by treatment to prevent the late symptoms of syphilis, and it is for this reason that we desire to discover cases that are existent but unrecognized. On the whole, the earlier treatment is instituted for syphilis the better the results. But it is not entirely easy to make a diagnosis of syphilis. In the last few years we have been greatly helped by the Wasserman test, but this is not a sufficient and final criterion. There is still much difficulty and much to be learned. But we do know that the most likely field for the discovery of syphilis is the family of the syphilitic patient. Therefore the modern, well-equipped and well-managed syphilis clinic makes the study of the families of the patients of the clinic an integral part of its service.

The examination, and treatment when indicated, of the family of the syphilitic becomes one of the greatest services such clinic offers the patient, his family, the community and the nation. As has been said, such plan is being followed to-day in the majority of syphilis clinics, but unfortunately only a very insignificant percentage of cases of syphilis ever reach the syphilis clinic. Many cases found in other parts of a hospital are not sent to the syphilis room nor thoroughly considered. Many cases are not recognized; many are treated by private physicians; many are in orphanages or with child-helping agencies. The beginning has, however, been made; the problem has been outlined; and many have become initiated into the circle of workers and so the work will increase.

But the problem we have set ourselves is to speak of the family of the neurosyphilitic. After what has gone before it can be quickly and briefly stated. The problem of the neurosyphilitic's family is the problem of the syphilitic's family. Then why say more? Is it merely an excuse for emphasizing the need of family treatment? That is only partly the reason. It is because it is rarely realized that the family of the neurosyphilitic is the family of the syphilitic. And so, purposely, we reiterate — the family (the spouse and children) of the general paretic is the family of a syphilitic, and the family of the tabetic is the family of a syphilitic. And thus these families become the heirs of all the scourges of the syphilitics, as briefly indicated previously.

To understand why it is necessary even to consider what ought to be a commonplace fact, axiomatic, accepted and acted upon, we must briefly consider the development of our knowledge concerning general paresis, tabes and other forms of syphilis of the nervous system. It must be remembered that the symptoms of the syndromes making the classification of general paresis and tabes occur years after the infection, and follow a long period of quiescence or latency in which the patient is free from gross symptoms. It was not until very recently that these conditions were recognized as syphilitic. At first a few students of the subject called attention to the frequency with which paretics and tabetics gave a history of syphilis. The suggestion of Moebius, little more than a generation ago, that paresis and tabes were syphilitic conditions in 100 per cent. of the cases, met with very great skepticism, but as our information increased and as new tests were discovered this hypothesis became more and more plausible. It seemed, however, too simple an explanation, too good to be true, as it were, and a loophole had to be found. This was furnished by Fournier, the great French syphilographer, who taught that paresis and tabes were the result of syphilis, but were not manifestations of active syphilis, occurring only where syphilis had previously been. He coined the term "parasyphilis" to cover this conception, and this term is still with us, though we have learned that its original conception was based on a false premise. This idea concerning paresis and tabes as parasyphilitic did much harm in diverting attention from the problems of syphilis, and its damaging influence is still only partially dispelled. It was not until 1913 that the final link in the chain of evidence that parasyphilis is active syphilis was forged by the discovery of spirochetes in the brain and cord of the paretic and tabetic by Noguchi and Moore.

Harmful as was the teaching of Fournier, it had the effect of stimulating men to disprove it, and led to the examination of the families of paretic and tabetic patients for further evidences of syphilis. With the discovery of a serum test for syphilis in 1906 by Wassermann, Neisser and Bruck, a new aid and a new impetus was given, and since then studies have been made by men in all countries, among whom may be mentioned Nonne, Régis, Haskell and Hyde. The findings differ only in percentages, varying with standards and methods; all agree that the devastation is great, the menace serious. Yet, despite the evidence on all sides, we occasionally hear, from those who have not themselves thoroughly studied the matter, statements that the children of paretics and tabetics who do not die early grow up into exceptionally fine specimens of humanity. It is because of such statements that we have felt justified in doing more than emphasizing what seems to us so obvious, namely, that spouses and children must be carefully studied for manifestations of syphilis. We therefore give herewith an analysis of our work in the families of syphilitic patients suffering from nervous system involvement, and compare them with those where the central nervous system is not involved.

It is a routine at the Boston Psychopathic Hospital to examine whenever possible the families of all our syphilitic patients. To do this it is necessary to get the spouse and children of the patient to report to our out-patient department. To obtain this end the aid of the social service department is invaluable, and without such aid it would be almost impossible to do the work adequately or efficiently. With such aid the majority of the individuals desired readily co-operate for examination and treatment.

We have thus far examined the families of 247 syphilitics, of which 160 families were of syphilitics suffering from general paresis, 72 of syphilitics without definite central nervous system involvement, and 15 with the diagnosis of tabes and cerebrospinal syphilis.

In the 160 families in which one parent was a paretic, 226 individuals were examined. If we consider the Wassermann reaction alone we find that it was positive in 23 per cent. of the group, or in 52 individuals. Of these 52 positive Wassermann cases, 33 were spouses and 19 were children suffering from congenital syphilis. It should be mentioned here that the Wassermann reaction is only a part of the examination. Many patients with syphilis give a negative Wassermann reaction. However, it is given preference here as having less error on account of the individual equation in examination, and because it is better standardized.

From the 72 families in which one parent had syphilis but no evidence of central nervous system involvement, 91 members were examined. In this group 35 per cent. gave a positive reaction, — more than 1 in every 3. Of these positive reactions 13 were found in the mate of the patient and 18 were congenitally syphilitic children.

The group of tabetic and cerebrospinal syphilis families is too small to merit consideration here, further than to say that the figures of syphilitic involvement ran slightly higher than in the other larger groups.

These Wassermann findings rate much higher than in the population at large, where the percentage of positive reactions is given by various investigators as varying from 5 to 15 per cent. In the

Psychopathic Hospital the average varies each year between 12 and 14 per cent. In the groups under consideration it ranges from 23 to 35 per cent.

One wishes to know, however, in what proportion of the families this positive finding occurs. It might be that a large number of syphilitics occurred in a few families, thus producing the relatively high percentage. But that is not the case. In the whole group of 247 families a positive Wassermann reaction was found in 68 families, or 27 per cent. In the 160 families of paretics it occurred in 45 families, or 28 per cent., while in the 72 families of non-nervous system syphilis it occurred in 19 families, or 26 per cent.

It should be borne in mind that the Wassermann findings do not represent the total of syphilitic involvement. In many syphilitics a negative blood Wassermann is obtained. Much of the syphilitic damage is represented by abortions, miscarriages, stillbirths and early deaths. No greater cause of race suicide can be imagined than syphilis. For example, of the group of 247 families 84, or 34 per cent., were sterile — had no children; of the 160 families of paretics 53, or 33 per cent., had no children. In the population at large the least productive group as to children is supposed to be the college-trained, but we find among the Harvard and Yale graduates only from 19 to 23 per cent. of infertile marriages in contrast to the 33 per cent. among paretics. It was found, further, that 20 per cent. of the families had abortions, miscarriages and stillbirths, while dead children occurred also in 20 per cent.

As a result we find the average of living children per family to be 1.3, a figure very much lower than necessary to keep the population stable. The figures are about the same for families in which the original patient had or had not nervous system involvement. The birth rate for the 247 families averages 1.7 children. From the United States census report it is found that the average birth rate in our vicinity is 4.4 children per family. But this difference betwen 1.7 and 4.4 does not tell the whole story. Were it not for syphilis the 4.4 figure would be higher, for that average includes the syphilitics. But of the 1.3 living children per family, many are afflicted with syphilis and will have a shortened life and a lessened efficiency.

To sum up, incompletely, what syphilis has meant to these 247 families, it will suffice to state that only 69, or 28 per cent., showed no defect as to children, 30 per cent. in the paretic and

27 per cent. in the other group. Only 61 families, or 25 per cent., showed neither defect as to children nor Wassermann reaction. These figures, it seems to us, show unequivocally that the incidence of syphilis is tremendously high in the families of the syphilitic, and that it is as high in the families of the paretics and tabetics as in those whose syphilis has not invaded the nervous system.

A few illustrations may be given as concrete instances.

Family 1. — A woman came to our attention suffering from general paresis. On examination of the other members of the family it was found that the husband showed the early signs of syphilis of the nervous system. The oldest son was brought to us with juvenile paresis well marked, and died four months after first being seen by us. The second son died a month later of ruptured aneurysm, at the age of 20, certainly due to syphilis. The third son had the stature of an achondroplasia. The fourth was a mis-shapen cripple with caries of the spine, while the fifth son although in good health, showed stigmata of congenital syphilis. There were three stillbirths.

Family 2. — A boy of fourteen, an only child, was brought to the hospital because he was backward mentally. He was found to have juvenile paresis. The father on examination proved to be in the early stages of locomotor ataxia. The mother was quite deaf, due to syphilitic involvement of the eighth nerve.

Family 3. — A man with general paresis had a wife and two apparently healthy children, all three having positive Wassermann reactions.

Family 4. — The husband had paresis; the wife showed no evidence of the disease. The older child, aged six, was feeble-minded and had a positive Wassermann reaction; a younger sister, aged four, was apparently bright and healthy, but also had a positive Wassermann reaction.

Family 5. — A woman came to us with her two daughters, aged eleven and nine, asking to be examined. Her husband had recently died of general paresis. She had heard that this was a syphilitic disease. From Brieux's "Damaged Goods," she had learned of congenital syphilis and hence her request for examination. She proved to have a positive Wassermann reaction. The older girl was anemic, underdeveloped, nervous, irritable and bore the unmistakable signs of congenital syphilis. She had a positive Wassermann reaction. The younger child was apparently well endowed mentally and physically, but also had a positive Wassermann reaction.

But why should we make these examinations that show such unpleasant findings? It is in order to help these sufferers from syphilis, who for the most part are innocent and unsuspecting victims. The characteristic of syphilis, mentioned above, to remain dormant or apparently inactive for a long period gives us the opportunity, if we grasp it, to apply therapy before the ravages have, in some instances, gone very far. Hence our desire to make the diagnoses early. Then therapy is of avail. In Family 1, it was obviously impossible to do aught for the first or second son, but probably much could be done for the fifth to keep him from going the path of his older brothers.

In Family 3 we have a striking example of the value of such examinations. Here is a mother and two children who, while apparently healthy, are suffering from syphilis. Treatment applied now may well prevent any future symptoms. The aim of medicine to-day is first, to prevent disease, and where that is not done, to discover it as early as possible, that treatment may have its greatest chance for success. By diagnosis, made possible by family examination, something can be done to prevent the spread of the disease; much can be done to prevent symptoms, and hope can be offered for healthy children by treatment applied to the parents before the birth of children, and often to the children themselves when no great damage has yet been done by the disease.

It is not our province to point out the methods of diagnosis or treatment. This, in every instance, is highly specialized work for the physician, but it may be well to insist that results of therapy in syphilis, and especially in late and congenital syphilis, can be obtained only after years of treatment, and that the patients must be under medical care probably for life.

To handle the problem properly education is essential, — education of the physician, the social worker and the layman. The value of education of the layman is shown by the illustration (Family 5) in which the mother, through her reading of "Damaged Goods," sought aid, when such aid had been withheld by physicians who had not done their duty in diagnosing the children as syphilitic.

As an argument against family examinations in syphilitics, it is sometimes said that there is grave danger of breaking up the family if it is learned that one member has syphilis. This is a very weak argument against examination, we should say, if by such examination steps can be taken to eradicate syphilis from the family. But the argument is *entirely* fallacious. In three years' experience with the families of syphilitics, and in dealing with more than 250 families, we have not broken up a single family, nor, we believe, brought undue unhappiness into any. We shall be able to begin to attack the problem of syphilis only when the knowledge of syphilis and its manifestations and ravages is widespread. To those who fear to tell a man or woman that general paresis and locomotor ataxia are syphilitic diseases we would give warning that before long this will be as common knowledge as that consumption means tuberculosis. And to those who have withheld this knowledge and allowed syphilis unhindered to reap its harvest, not thanks but rather recriminations will come.

In closing we would repeat that the families of syphilitics show syphilis in a very high percentage; that the families of paretics and tabetics are the families of syphilitics; and that the families of all syphilitics should be thoroughly examined that treatment may be instituted where indicated.

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A WIDER FIELD OF ACTIVITY FOR THE AMERICAN MEDICO-PSYCHOLOGICAL ASSOCIATION.

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The American Medico-Psychological Association has a dignified history of nearly seventy-five years of continuous activities. Founded in 1844, it has consistently maintained standards which have made it one of the most prominent of the medical organizations of the country. It was conducted for nearly fifty years as the official organization of the superintendents of the American institutions for the insane, and only adopted its present designation after the reorganization in 1892, when its membership became more general.

It now includes as active members physicians "especially interested in the treatment of insanity," or who "by their professional work or public writings have shown a special interest in the care and welfare of the insane." Laymen who "have distinguished themselves by their attainments in branches of science connected with insanity, or who have rendered signal service in philanthropic efforts to promote the interests of the insane," are eligible to honorary membership. The association has assumed a position of prominence among the scientific organizations of the country, and includes in its membership practically all of the prominent American psychiatrists of the day.

It has, however, unnecessarily and unwisely relinquished its official representation of the various State bodies responsible for the management of the institutions, public and private, for the insane. In so doing it has failed to take advantage of the opportunity of encouraging and assisting in the maintenance of high standards of care throughout the country, of influencing legislation conducive to the welfare of the insane, and of guiding the destinies of the institutions as it should.

The association should be the most powerful factor in the country in obtaining State recognition of the needs of the insane, in fostering legislation which will prevent political interference with the hospitals, and in bringing the standards of care up to the high plane represented by ideals kept constantly before the public by this organization since its foundation in 1844. If this is to be done we must include in our membership the men who control the policies of the institutions in the various States.

For this purpose I would suggest for your consideration, if necessary, an amendment to the Constitution which would render eligible, *ex officio,* as active members all duly elected or appointed managers or trustees of State hospitals for the insane, and all members of commissions and boards of control having administrative or financial responsibility for State institutions for the insane, such eligibility to continue while actually in office. They should, of course, be required to pay annual dues and be subject to all the requirements of the Constitution applying to active members. If the association is not to be an official organization representing the institutions for the insane, and it has not been since 1892, it should at least include in its membership the managing and governing bodies vested with the administrative control of the hospitals in the various States and provinces. This subject might very properly be referred for further consideration to a committee to be appointed by the president.

The association should, in my opinion, be something more than a purely scientific body, meeting annually for the presentation and discussion of papers relating to psychiatry. It should officially exercise the functions which the professional qualifications and official position of its active members would fully warrant. No other one thing would go so far towards insuring the humane and proper care of the insane in this country.

The report of the committee on statistics at this session calls attention to another phase of activity of the association which has been under consideration for many years. At the twenty-third annual meeting, in 1869, Dr. Nichols called the attention of the association to a system of statistics adopted at the International Congress of Alienists held in Paris in 1867. A series of statistical tables, twenty-one in number, were prepared by a committee and used unofficially for several years, although for some reason never formally adopted. Another committee reported on this same subject in 1896, unfortunately without any definite action.

At the present time we are without any statistics on the insane of the country which can be correlated and made a subject of scientific study and investigation. With a wealth of material available which would go far towards solving many important problems relating to psychiatry, we find the various States, and more often individual institutions in the same State, working along entirely dissimilar lines.

Our textbooks are filled with uncorroborated assertions relative to the frequency of certain forms of insanity. These are often based on the personal experience of the author or on statistical data available from his own hospital. The official publications of a few isolated States give such information in an intelligent form, but any one who wishes to compare conditions existing in one community with those in another, or make comparative studies of large numbers of cases, almost invariably finds the necessary information unavailable.

Accurate statistical data showing the etiology of insanity are published in but few places, and the discussions of this subject are based more on opinion than on the study of a sufficient number of cases to warrant any conclusions. The same absence of authentic information renders it impossible to obtain any accurate knowledge regarding the recovery rate of the different psychoses. Dementia præcox is conspicuously absent from many of the hospital reports which include primary dementia, chronic delusional insanity, terminal dementia and other conditions which may or may not belong in the dementia præcox group.

When statistical reports are made they usually contain information which is of itself very largely useless relating to the civil condition, color, sex, age, residence by counties, financial status, etc. Unless the psychoses are shown in these tables they are of no value whatever. In any event, it is impossible at the present time to obtain statistics regarding any one phase of insanity which is of any importance from more than a very few States where the insane population is unusually large.

Accurate statistical reports made along uniform lines would enable us to reach important conclusions regarding the frequency of occurrence of the various psychoses, the probability of recovery, the intercurrent affections causing death, etc.

A uniform basis for financial reports made annually to the association would be of incalculable benefit. This would not conflict in any way with returns made to local fiscal officers. Our attention is often called to the apparent fact that the per capita cost of maintaining the insane in certain States is unreasonably high, whereas they are cared for at a much lower rate in other communities. This has frequently been made the subject of legislative investigation, usually with highly misleading conclusions owing to the fact that we have no uniform way of computing costs. Some institutions in reporting the cost of maintenance deduct from the gross expenditures the receipts from all sources, including the care of reimbursing patients and the value of all farm and manufactured products. Others very properly do not. Some include only the ordinary repairs and replacements, and others the cost of new and additional equipment, extraordinary repairs and even additions to buildings. The result is that, if the statements published in annual reports are taken at their face value, the same methods of administration that would appear penurious in one institution would be interpreted as gross and almost criminal extravagance in another.

The reports of the State Hospital Commission in New York have been enlightening as to the burden of maintaining aliens in our public institutions. It has been shown that there are now about 9,000 patients in the hospitals of that State who are not residents of New York or citizens of the country. The actual maintenance of these aliens is costing the State approximately $2,000,000 per year. This is undoubtedly a condition which exists in practically the same relative proportions in the other States. The facts which are necessary for an intelligent discussion of this important question are, however, lacking because this subject has not been generally included in statistical reports.

The national and various State mental hygiene societies have been endeavoring to educate the public regarding the importance of the relation existing between insanity, syphilis and alcohol. Unfortunately, statistics on these subjects cannot be obtained in many of our larger communities.

In view of the objects and purposes of the American Medico-Psychological Association it would appear to be the obvious duty of this organization to endeavor to remedy this unsatisfactory condition of affairs. The report of the committee on statistics has pointed out the way in which this can be accomplished. The approval by the association of a scheme of uniform statistical reports of the insane will unquestionably insure the success of such a movement, and a concerted effort on the part of our members is quite sufficient to bring about the adoption of these statistical forms in the various States and insure their general use.

I would strongly urge upon the association the advisability of establishing a bureau of statistics for the purpose of compiling and publishing annual reports on the insane in all the States and provinces as far as obtainable. Such a bureau could probably be maintained at a comparatively small expense in cooperation with the National Committee on Mental Hygiene.

The success of "The Institutional Care of the Insane in the United States and Canada" shows conclusively that undertakings of this magnitude are entirely practicable if the association will assume the function which properly devolves upon it of correlating the work done by the various States. It would appear to be practically certain that the Federal authorities can be induced to arrange for a census of the insane based on our official classification, which will, for the first time, furnish us with intelligent information on this important subject. If the association accomplishes nothing else this would constitute one of its most important contributions to medical progress.

ON THE FOCALITY OF MICROSCOPIC BRAIN LESIONS FOUND IN DEMENTIA PRÆCOX.

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Abstract.

The task of microlocalization.
Work of the topographers.
Problems of a pure functionalism.
Anomalies in dementia præcox brains.
Crucial importance of histology of normal-looking brains in dementia præcox.
Dissociation of parenchymatous and interstitial lesions in certain cases.
The stratigraphical analysis of the cerebral cortex, supracortex and infracortex.
Many effects of mental dissociation (schizophrenia), probably correlated with supracortical disease.
Correlations of hallucinosis and catatonia with infracortical disease.
Topographical analysis; *à priori* probabilities.
Tendency to lobar and lobular focality of lesions.
Delusions: frontal; catatonic symptoms; parietal; auditory hallucinosis; temporal.
Exceptional delusions of a fantastic nature probably parietal in origin.
Analysis of four cases.
Summary.

The present attitude of investigators of the mind and its diseases has to pursue the study of the nervous system along lines roughly summed up in the term microlocalization. But this task must not be conceived narrowly as a task of the histoneurologist or the histoneuropathologist. Microlocalizations in the nervous system and especially in the cerebral cortex are threads running to the broadest issues of physiology, embryology and psychology. Yet no one feels that psychologists, embryologists, physiologists, anatomists, or even pathologists in the narrower sense of the term, will solve the problems of microlocalization or even demarcate its problems for solution. When the idea of Flourens, that the brain parts were mutually exchangeable in function like so many liver parts, was replaced with the ideas of topographical differentiation, which we attach to the work of Hughlings-Jackson and of Hitzig, it was as if the naked eye of observation was replaced with a lens of considerable power. The situation now is that this lens of great power, provided by the work of the embryologists, the physiologists and the clinical anatomists, must be replaced with a lens of still greater power, one that will permit us logically to face problems of microlocalization thus attaching to physiological complications within the single gyrus. It has become a commonplace that the brain is a congeries of organs. It is not so well understood that each gyrus is a wonderland of structures and functions in which rich results are to be expected from hard but fascinating research.

As we look over the history of these developments we of course find that Bevan Lewis had, in advance of his time, laid down the idea of cell differentiation within the cerebral cortex, clearly distinguishing the large cells of the motor cortex, for example. In much of the work of Meynert and Flechsig the idea of microlocalization can be discerned. However, even in the embryological considerations of Flechsig the notion of the gyrus as little more than a functional unit is the prevailing idea. Decades were devoted to the isolation of one neurone after another by ingenious technical methods, and to developing the conception of the nervous system as a mass of embryologically and functionally separate units, expressed, for example, in the neurone hypothesis of 1891. Listeners to the lectures of Nissl became familiar with his ideas of the structural and functional differentiation of the various cortical parts.

The idea of microlocalization scarcely flourished to the full in the last decade of the nineteenth century, however, since workers were engaged in assimilating the principles of Weigert concerning neuroglia and in trying to find qualitatively the same sort of lesions in the nervous system that they were finding in other organs. In fact, this search was neatly culminated in the establishment in the years 1899–1904 of general paresis as a definite example of chronic inflammation of the nervous system. The pathologist was here trying to find and succeeded in finding certain lesions scattered in different parts of the nervous system, and lesions of qualitatively the same sort throughout. Nor in the rush of new ideas was the material in general paresis used to the utmost in throwing such light as it might on the problem of microlocalization. Thus, had the world been seriously trying to find out the nature and genesis of mental phenomena and symptoms, it would surely have executed elaborate studies in the distribution of the characteristic paretic exudate, with the idea of correlating these local variations in exudate with processes and symptoms. The issue of such an investigation could only have been positive or negative. As it stands, the situation is doubtful. In fact, it may be confidently doubted whether the paretic exudate in paresis is not itself responsible for many of the characteristic symptoms in paresis, for example, grandiosity, amnesia or even dementia, which are not found to correspond even roughly with the amounts of exudate discovered in the brains. So far as paresis is concerned, very possibly it was more important to determine it to be syphilitic and to embrace eagerly the opportunities afforded of a Wassermann reaction than to pursue seemingly recondite studies in micro-localization. Meantime the topographical anatomists were laying down the results which the pathologist could at last employ without signal loss of time.

When the interesting and fundamental work of Hammarberg appeared on the histology of feeble-mindedness in 1895 it was plain that this Swedish investigator had had to spend more than half his time, not on the histopathology of feeble-mindedness, but upon normal histology. The situation is now greatly improved with the work of Elliot Smith, who showed that even the naked eye will, under proper conditions, detect striking differences between the gyri of different parts of the brain on section, and especially with the work of Campbell who, after an extensive study of the histology of the different gyri, has offered a valuable atlas with a store of functional comments and speculations.

Even before Campbell, Bolton had laid down exact lines concerning the histology of different parts of the occipital region, and had contributed the idea of visuo-sensory and visuo-psychic regions therein. Similar work has been done by Brodmann in Germany, who, however, feels that functional speculations are hardly in point at the present time. Visitors in the private laboratory of Vogt in Berlin some years since must have been impressed with the tremendous elaboration of structures which could be demonstrated in the different parts of the brain, even by so simple a technical method as the method of Weigert for myelin sheaths. For decades, also, the world has been watching the development of the ideas of Ramon y Cajal, whose labors stand not second to those of Bolton, Campbell, Brodmann and the rest of the topographers.

In fact, the research situation is theoretically so promising in view of the progress along all these lines by workers in different countries that it is a little surprising that so little neuropathological application has been made of the results as attained. There seems to be a curious lack of tempo in neuropathological research. Bevan Lewis' ideas of cortex differentiation came, it would seem, too early to affect the main current of investigation. The work of Donaldson in 1889–90 upon the brain of Laura Bridgman has not been followed up by any considerable series of similar investigations, and the Laura Bridgman work apparently led its author to deeper considerations of growth and development rather than to progress along the line of neuropathology.

Again, throughout the nineteenth century, there prevailed the Wundtian psychology. The reader of Wundt's analysis of aphasia, for example, is convinced that, despite the profound distinctions made, the philosopher was no longer a physiologist, and set himself the task of anti-localization in the spirit of a system-maker rather than that of an independent seeker after facts and independent interpretations. The idea of the unity of the mind, a very fine-grained and closely interwoven unity, has prevailed in many quarters, perhaps in all quarters, dominating research. To these psychic unitarians it would have seemed almost a pity if any one could show, for example, an identity of speech processes with processes of the left inferior frontal gyrus. To the conservative wing of the psychic unitarians was added the force of those strictly scientific persons who feel that a fact is a fact and a speculation is necessarily a bad speculation. Thus, for example, if the simpler ideas of Broca concerning speech localization ought to be modified by the modern concepts of Marie, then this is scored as a victory by those holding to the adamantine unity of the mind on the one hand, and by those who are skeptical of all scientific results in the psychic field of whatever sort.

Added to this situation was the Freudian tendency. Disregarding the truth or falsity of the Freudian contentions, it is clear that his followers are engaged much more in finding satisfactory categories of a logical nature in which to place globar tendencies shown by their patients than they are in conceiving the brain functional lines along which an hysterical dissociation might proceed, a repression be mechanized or a censor be enthroned.

Inasmuch as Descartes made a laughable error in assigning the seat of the soul to the pineal body, it is best for the modern to "play safe" by failing to notice both the pineal body and the brain itself, and to solve the problem either by denying that it exists or by failing to consider it at all. One of these modern worthies assured me some years ago that there was no doubt a correlation between mental processes and brain processes, and that theoretically the "needle" of demonstrable lesions could be found in the "haystack" of neuronic brain systems, but that for his part he regarded that problem as theoretically solved, and desired to get on with something genuine and practical.

Accordingly, the academic psychologists, if we may so term the Wundtians, and the Freudians, have alike little interest in the matter of microlocalization, that is, in the correlation of mental with brain processes, either normal or pathological.

It is therefore almost with a feeling of being alone in the wilderness that one endeavors to work in the direction of neuropathological correlation; either there is no problem or it is theoretically settled beforehand. A psychiatrist of light and leading asked me one day what, after all, I was about in working along structural neuropathological lines. Anybody with a logical turn of mind and any capacity for observation ought rather to be busily applying the modern categories of psychopathology to clinical psychiatric and neurological material.

If such doubt of the fundamental value of this kind of work could prevail in the mind of a leading psychiatrist, I felt that I could do no better than bring these general ideas before the Association of American Physicians.

It is as possibly throwing light on the problems of microlocalization that the material in dementia præcox struck me as of value. To be sure, the world was full of a rather empty discussion as to whether dementia præcox was an organic or structural disease. Any one who professes to find brain changes in dementia præcox was perforce regarded as a controversialist, engaged in demolishing the ideas of some workers who wanted to show that dementia præcox was a disease of maladaptation, or a disease with so-called Freudian mechanisms. Let me say, therefore, that to embark on studies of the brain in dementia præcox and to find brain changes therein is not at all to deny that dementia præcox is an instance of maladaptation of the individual to his environment, and not at all to deny the possible importance of Freudian mechanisms in the disease.

In 1906 I began to study the brain problems of dementia præcox, and collected first fruits of that study at the Medical Congress in 1910 and 1913.[3] I then showed that the brains of dementia præcox subjects were extremely likely to show evi-

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dences of anomaly; that even when there was no anomaly there were very likely to be microscopic changes. To be specific, I found 23 out of 25 carefully studied brains to be significantly anomalous. I do not mean that the anomalies shown were visible the whole length of the demonstration hall as they are apt to be in brains of the feeble-minded, but I mean that the asymmetries and irregularities were of a demonstrable and photographable nature. Friendly critics offered the suggestion that similar anomalies were to be found in brains of normal persons. Unluckily the brains of normal persons, in large numbers, are not available so far as I know in any laboratory in the world, at least in such a state as to permit proper photographic analysis. However, I think I am able to answer these critics by showing that the brains of subjects of the so-called manic-depressive psychosis show such anomalies in very few instances. Using certain criteria, I found four-fifths of my dementia præcox brains to show such anomalies, and but one-fifth of the manic-depressive brains were similarly affected.[5]

But it is one thing for a brain to be anomalous and another for it to be functionally disordered. The underlying hypothesis here is that the anomalous regions of the brain are in some sense weak places therein, such that disease of a toxic or metabolic nature, *e.g.*, at puberty, may unfavorably affect the anomalous and poorly constructed region. These considerations I presented with some histological confirmation at the 1914 meeting of the association in the paper "On the Direction of Research as to the Analysis of Cortical Stigmata and Focal Lesions in Certain Psychoses."[6] Further reflection on this finding led me to the considerations about tissue decomplication developed at the 1915 meeting.

But it was clear that the few cases of normal-looking brains in dementia præcox formed the crux of the situation, since the critics of material from anomalous brains might properly charge the investigator with inability to cull out the acquired from the inborn lesions. I therefore determined to study with sufficient intensiveness the brains of cases of dementia præcox that showed no anomalies or scleroses. In connection with this study five brains were investigated, four of them looking in the general direction of dementia præcox and one of them in that of manic-depressive psychosis. These five brains were the residuum of a series of 120 coming from psychoses of all sorts.[4]

Before I could bring the topographical problem into clear relief I found that in the analysis of these five brains the problem of parenchymatous *versus* interstitial lesions stood out. At the 1916 meeting I presented the conception that in the nervous system there should be a dissociation of lesions somewhat similar to that in the kidney.[7] To be sure, the parenchymatous and interstitial lesions of the kidney are, as is well known, often if not almost always commingled. But the fact that the lesions in these two types of renal tissue are so commingled in a given case militates not at all against the idea that there are, roughly speaking, two kinds of nephritis, — parenchymatous and interstitial. The same theoretical situation holds in the nervous system. I found that parenchymatous and interstitial lesions could be dissociated and combined in the nervous system much as similar lesions could be dissociated and combined in the kidney. To be sure, the parenchyma of the nervous system was a parenchyma composed of neurones and their adnexa, and the interstitial tissue of the nervous system was complicated by the fact that a great deal of it is neuroglia tissue, embryologically different from the interstitial tissue of the kidney. Nevertheless, it is well known that many of the properties of neuroglia of ectodermic origin are similar to the properties of mesodermic interstitial tissue. The alterations of the mesodermic interstitial tissue, also existent in the nervous system, are of far less consequence than those of the neuroglia tissue. The one case of manic-depressive psychosis, intensively examined, failed to show convincing degrees of parenchymatous lesion, but the dementia præcox case had well-marked parenchymatous disorder, that is, varying degrees of cell loss, to which the interstitial reaction, that is, gliosis, was found to be not at all proportionate. The result of this study seemed to be that parenchymatous disorder, *e.g.*, cell loss and interstitial disorder, *e.g.*, gliosis, must be investigated separately if we are to make headway in this group of cases. Thus it would be decidedly unwise to argue from the data of neuroglia preparations that the gliosis of such and such an area was an indicator of parenchymatous loss. To be sure, the gliosis is probably an indicator of something of general or local significance in the brain. But no facile application of the principle suggested by Weigert's neuroglia work could safely be made. Even if gliosis, as a rule, signifies some degree of wear and tear on the part of the parenchyma of the part affected, yet there was no good evidence that the gliosis was at all proportionate to the parenchymatous wear and tear.

Having thus shown that the brain conditions roughly corresponded to, *e.g.*, renal conditions, and that the histopathological analysis of injured brain tissues must look in both these directions in search of successful correlations, I proceeded to a stratigraphical analysis of the finer cortex changes in these brains, presenting results at a meeting of the American Neurological Association.[8] I tried to study separately the nerve cell losses on the one hand, and the gliosis (including satellitosis) on the other hand, and then to learn whether the character of these changes in the upper and lower layers of the cortex was of any functional significance. For convenience, I wish to term the upper layers of the cortex supracortical and the lower layers infracortical. In fact, it might be well at times to speak of the supracortex and the infracortex. The comparative anatomists seem to have demonstrated the importance of some such distinction, and the literature has for some time contained references to the so-called suprastellate (supragranular) and infrastellate (infragranular) layers of the cortex. Omitting controversial details, it appears that almost all workers are committed to the idea that the majority of the supracortical structures are of more recent evolution than the majority of the infracortical structures. As many of the mental functions in man are of recent evolutionary origin, and as all signs point to the cerebral cortex as somehow engaged in these processes, it seems natural to assume that the supracortical layers, or what we may term the supracortex, is the basis of many of these higher psychic functions. On the same plausibility we may argue that the infracortical layers, or infracortex, is the basis of such mental or quasi-mental functions as are found in those animals possessing an infracortex and not yet a supracortex.

All these interpretations are independent of any topographical conceptions, and for the purposes of generalization one neglects for the moment the important distinction of the archipallium and neopallium, developed by Elliot Smith.

Taking the whole cortex, by and large, modern work seems to me to invest the supracortex with higher psychic functions than the infracortex.

Now in a disease like dementia præcox as psychologically formulated by Bleuler we find the main feature to lodge in what Bleuler terms schizophrenia. This most valuable term expresses what one might call "split-mindedness," or mental dissociation. Much of modern psychology, whatever may be said to the contrary, is founded on the work of the associationist school of, *e.g.*, John Stuart Mill. We should hardly get on without some of Mill's so-called mental chemistry. Well, for better or worse, associative processes must have their obverse in dissociative processes, and the measure of mental dissociation is the degree of schizophrenia in Bleuler's sense. Kræpelin himself who, on purely clinical grounds of a combination of certain symptoms in certain ways, laid down the conception of dementia præcox, has so far admitted the validity of Bleuler's conception of schizophrenia as to use the term schizophrenic very frequently in his description of patients. In one of the most exquisite examples of schizophrenia, viz., the finely divided cleavage of speech known as *Wortwirrtheit,* Kræpelin has constructed the term "schizophasia" on the analogue of schizophrenia.

We mean, then, by schizophrenia a process of mental dissociation of a psycholitic or ideolitic process. The cleavage may lie between the intellect and the emotions, so that the emotions do not at all fit the ideas entertained by the patient; or the cleavage may lie between the emotions and the will, and a bizarre conduct may fit a certain quasi-normal state of feeling. But the cleavage is not necessarily so elective and total. The cleavage may be within some particular train of thought. Here is schizophrenia in its best display. Instead of the regular train of thought we may have a train of thought like a telegraph despatch, or even a train of thought suggesting in its obviously inappropriate sequence a cypher or a set of types reduced to pi. But absolutely pied thinking is not the rule, and the so-called word "salads" are often but passing phases in the development of a dementia præcox course. Here is not the place to expound or to describe schizophrenia. Inasmuch, however, as many of the schizophrenic effects that strike the observer as so bizarre in dementia præcox thinking are probably correlated with the operations of the outer layers, that is, of the supracortex itself, you have to inquire whether cases of this order show lesions preferably in the supracortex. Of my four cases of dementia præcox all showed lesions in the supracortex in the nature of cell loss and of more or less disproportionate gliosis, except one case. This case was one approximating the so-called paranoia, a disease perhaps allied to dementia præcox, but often running years or throughout life without any of the bizarre psycholitic, schizophrenic, thought-splitting phenomena here under discussion for paranoiacs of this rare description (there may be in a dozen institutions in Massachusetts at this time not more than 25 or 30 of these particular cases) present quasi-normal appearances that have been described sometimes as psychic malformations, and often give the impression of ability to fit in to a reconstructed world, with the patients in the center as kaisers or I. W. W. chiefs therein. In short, many of these paranoiacs, victims of the severest and most intractable psychosis known, are nevertheless without a trace of mental splitting such as I have hinted at above. And in fact the paranoiac in question showed no signs of mental dissociation, but rather showed signs of what might be termed a hypersynthesis of such facts in her environment as fitted her morbid ego and her jealousies. What I am getting at is that the psychopathological analysis of this case of paranoia precisely did not demand any evidence of supracortical disease; in fact, had there been supracortical disease of any moment we should have wondered whether there had not been some disintegration of the patient's personality, at any rate at the close of her life. It is interesting that this particular paranoiac did show some infrastellate disease which, as will be mentioned below, I regard to be correlated with auditory hallucinosis which she showed.

The other three cases intensively examined (I may recall that notes were made as to different types of cell loss, gliosis, satellitosis, vascular changes, etc., for each layer in each of 25 to 30 areas of the cortex in each subject) showed signs of supracortical disorder as well as of infracortical disorder of varying degrees in different parts of the cortex, and all three of these cases showed signs of schizophrenia. This evidence is at least suggestive that supracortical disorder is necessary in schizophrenia. I felt satisfied in my own mind, from the results of the work, that not only is the cerebral cortex the proper study of the psychologist and the psychiatrist, but that the supracortex is in a still more intimate sense the proper study of the psychologist or psychiatrist who has to deal with the higher functions of what may be called psychic association or synthesis. To my mind such studies, if in future confirmed, will throw an important added light upon the problems already partly illumined by comparative anatomy.

Let me insist here, if it is not superfluous, upon the fact that I am not proposing an hypothesis to the effect that every time a mental split occurs a cell drops out of the supracortex. I do not even see in my mind's eye a dendrite dropping off of a supracortical cell to signalize the cleavage of an idea. There is very properly much fun to be made of workers who regard ideas as fine transparent substances poured in and out of nerve cells as wine in and out of goblets. Aside from the problem of parallelism and interactionism, suggested by the figure that regards brain cells as vehicles for ideas, my own contentions deal rather with the observational facts. I would regard all gliosis as merely indicating and not defining the type of cortical disease in question, and I should regard the nerve cell losses or other changes as likewise nothing but indicators of the kind of thing going forward, or perhaps as indicators that something or other is going forward in the injured tissue. To be sure, I would think that destructive brain changes would be more likely to be associated with mental dissociation (with schizophrenia, gliosis) than with other types of synthetic or redistributive mental processes. Supracortical neurone psycholysis, to put the whole matter in a formula, is to my mind correlated with schizophrenic processes. What, you may well ask, is to be correlated with hypersynthetic, falsely synthetic or redistributive mental processes of the mind-twist sort? For the present I, for one, have no idea what cortical process corresponds to these non-destructive morbid psychic processes. Mind lack and mind loss should correspond with the cell lack and cell loss.[2] What we term figuratively mind twist, *e.g.*, false reasoning without loss of sensory intake and power, without loss of memory images, without loss of power of expression, without any evidence of coarse loss of function, remains as a process not readily statable. Perhaps we must fall back here upon the idea of physico-chemical changes and of anomalous distributions of energy in normal neuronic systems. But these are speculations so remote from observational facts that so far as I can see they cannot do the observer any harm.

Besides schizophrenia there are other bizarre effects in dementia præcox. Perhaps the strangest thing in the world is catalepsy. Catalepsy, catatonia, cerea flexibilitas are not infrequent symptoms in many cases of dementia præcox. They all have the character of muscular hypertension somewhat suggestive of hypnotic effects, or, again, of the effects of drugs upon the muscular system. Sometimes the phenomenon of negativism and resistivism remains one of the Sherringtonian experimental effects showing innervation of antagonistic muscle groups. Possibly these processes are to be explained upon some general line as schizophrenia; possibly they are due to some kind of lysis;

some workers are inclined to show the concept of inhibition very freely in the attempt to explain them. They are often a transient phase recurring again after comparatively normal intervals in a schizophrenic patient, and it seems impossible to evoke them by any form of stimulation of the patient.

In a general way such conditions as catalepsy seem a good deal more like phenomena produceable in lower animals than would schizophrenia. Some of the hypnotic or pseudo-hypnotic appearances in lower animals roughly resemble the catatonic effect. It was in a case of catatonia that Alzheimer first stated that there were nerve cell changes in dementia præcox, and it will be remembered that he placed these changes (chiefly gliosis) in the lower layers of the cortex. To a certain extent, my own investigations here confirm those of Alzheimer; at all events, in the case showing catatonia there were lesions in the infracortex.

Another symptom not at all so bizarre as schizophrenia and catatonia is hallucinosis. Hallucinations are rather quasi-normal effects that the normal person rather readily understands and that occur in a great number of mental diseases. Hallucinosis is in short a far less pathognomonic symptom for dementia præcox than is either schizophrenia or catatonia. Many forms of hallucination seem to be of so simple a nature that they could well be elicited in the lower animals could we only get at the psychic interiors of the lower animals to learn their mental contents. *À priori*, therefore, it seemed to me that the disease process underlying hallucinosis ought rather to be in the infracortex than in the supracortex, and there was some confirmation of this idea in the case studied. I mentioned above the fact that late in the disease the paranoia patient developed auditory hallucinosis. She showed infracortical cell loss of a mild but distinct degree. It will be remembered that the brain of this case was the most nearly normal of all the brains so far studied in the whole series.

The stratigraphical analysis of these brains proved, accordingly, very alluring. I seemed to get evidence that the supracortex was a region whose disease might well spell schizophrenia, whereas the infracortex was a region whose disease was related with lower level symptoms, such as catatonia and hallucinosis. The supracortex and the infracortex would then be regions of differential interest for the psychiatric investigator who would seek in the supracortical region for evidences of higher intellectual disorder in the field of association combination and abstraction, and in the infracortex for evidences of lower forms of mental disorder, such as catalepsy and hallucinations. I would not stick on the question of higher and lower functions at this point. Catatonia may well be a far more complex matter than many forms of intellectual dissociation. I call it lower because it seems to me that the simpler organism could show catalepsy rather than disorders of combination and abstraction in the intellectual field.

I have latterly reviewed the cell findings in the different cortical areas, assuming that I should find rather suggestive topical correlations between special kinds of symptom and special loci. I assumed that *à priori* no one would be likely to hunt for the source of auditory hallucinations in the small zone as defined by the comparative anatomists, and that one would hardly be likely to look for the basis of visual hallucinations in the superior temporal gyrus.

Perhaps, in accordance with the opinion of the learned psychopathologist above mentioned, it is *à priori* certain that in point of fact auditory hallucinations have their basis somewhere in the temporal lobe, and visual hallucinations somewhere in the occipital region, and why undertake a superfluous task of setting out exactly where and under what conditions they occur? We ought to be greatly helped in this matter by the focality of lesions in dementia præcox.

In the beginning I had been attracted by the fact that there was often a lobar or lobular hypoplasia and atrophy or sclerosis in these brains. In fact, I had tried reasoning from the gross data alone to draw tentative conclusions as to the main lines of functional differentiation in the symptoms of dementia præcox. Noting how difficult was the distinction between inborn anomaly and acquired lesion, and how uncertain one might be that a given hypoplasia had anything to do with a given disorder of function, I felt that I ought, perhaps, to investigate cases without gross lesions.

Now one of the most generally significant results of this intensive examination of numerous areas and all layers in dementia præcox brains is that there is a certain focality in the microscopic lesions. I still find the focality to be rather a lobar or lobular one than an intragyral focality. To be sure, my colleague, Dr. H. I. Gosline,[9] has made some interesting observations upon some exquisitely focal lesions of intragyral distribution, possibly related with tuberculosis in certain dementia præcox brains. Gosline has endeavored to show that the situation of these lesions (demonstrable by fat stains) is such as to fit with my own older contentions as to the relation of certain symptoms to particular regions. Notably Gosline endeavors to confirm my idea of the correlation of catatonia to post central lesions. My own work, as here reported, deals not with results of fat stains, but with the results of the study of cell losses by the ordinary tinctorial methods for determination of tubercle, at least with nerve cells (Cresyl violet after formalin fixation). I have tried to show the cell losses thus made out as a little more reliable than the fat-stained cells and deposits that Alzheimer, Cotton and Gosline have used. Using the methods of these observers I obtain too rich a display of lesions, as a rule, to permit correlation.

The kind of focality of lesions which I believe to have demonstrated in these brains is not intragyral, but lobar and lobular, or in certain cases a focality of lesions affecting the whole gyrus. By and large, in these brains as one examines the different layers within a gyrus, the layers are apt to show throughout the gyrus the same kind of lesions, whether gliosis or cell losses. In short, the focality of these lesions is not the focality of tubercles, tumor masses, glanders lesions or exudative lesions. It is rather a focality such that, *e.g.*, the post central gyrus on one side is affected in a certain way throughout the gyrus with such and such layers homogeneously affected. The post central gyrus of the other side is relatively normal.

What now are the functional results of a study of the topographical distribution of the lesions just mentioned? Can we by focalizing attention on certain gyri discover functional correlations of lesions with certain symptoms?

The functional correlation of my dementia præcox studies, published in 1910 and 1914–15, were summed up from the topographical point of view as follows: —

1. Delusions are, as a rule, based on frontal lobe disease.
2. Catatonic symptoms are, as a rule, based on parietal lobe disease.
3. Auditory hallucinosis is, as a rule, based on temporal lobe disease.

Re the frontal lobe correlation with delusions, I found an exceptional group of delusional cases without frontal emphasis of lesions, but I found a plausible reason for these exceptions. Upon analysis the non-frontal cases of delusion formation turned out to be cases with a tendency to what may be termed hyperphantasia, that is, to an elaboration of fantasies not more than half believed, or at any rate not fully believed, by the patient. It is clear that from what we know of the probabilities of localization in the brain, both from a comparative and anatomo-clinical point of view, the parietal lobes might plausibly be implicated in the function of imagination, and that parietal disease might well be attended with functional disorders of imagination, such as overimagination, or what is here termed hyperphantasia.

It is plausible to argue that the parietal tissue, newly evolved in the higher animals, lying between the tactile post central region and the visual occipital region and the auditory temporal region, should be a tissue related with apparatus for combining these sensory data, — a tissue which might unobjectionably be termed a center for combining percepts and concepts involving two or more forms of sensation or perception. Whatever the merits of this *à priori* contention, at all events I found a tempting correlation of fantastic delusions with parietal lobe atrophy. I summed up the anatomical situation as follows: —

On the whole, the correlation between delusions and focal brain atrophy (or aplasia capped by atrophy?) is very strong, particularly if we distinguish (1) the more frequent form of delusions with frontal-lobe correlations from (2) a less frequent form with parietal-lobe correlations.

The non-frontal group of delusion-formations the writer wishes to group provisionally under the term "hyperphantasia," emphasizing the overimagination or perverted imagination of these cases, the frequent lack of any appropriate conduct-disorder in the patients harboring such delusions, and the *à priori* likelihood that these cases should turn out to have posterior-association-center disease rather than disease of the anterior-association-center. This anatomical correlation is, in fact, the one observed.

My previous work had also suggested a possible correlation between catatonic phenomena and parietal (including post central disease). Ten of fourteen definitely catatonic cases yielded gross lesions in the parietal or other post-Rolandic regions. Of the remaining four, two, negative in the gross, proved to be microscopically altered in the parietal region, and there were indications of a correlation in the remaining two cases. It must be remembered with respect to correlation that I am using the term "catatonic" here as the name of a symptom. I am not offering a correlation between anatomical or microscopic lesions and the catatonic form of dementia præcox.

For example, the symptom cerea flexibilitas is not necessarily an indicator that the victim belongs in the so-called catatonic form of dementia præcox, despite the fact that cerea flexibilitas is one of the prettiest examples of catatonia ever described. Four of the five cases in the 1914–15 series that showed cerea flexibilitas had parietal anomalies or atrophies, and the fifth case, though it was entirely negative in the gross, was a case which showed an extreme degree of satellitosis in the post central region examined microscopically. These observations and certain *à priori* considerations led me to formulate the idea that catatonia, and particularly cerea flexibilitas, was a form of disorder of kinæsthesia.

Re the correlation of auditory hallucinosis with temporal lobe lesions, it is easy to see that such a correlation ought to exist if any gross correlations at all were expected. In point of fact, nine of my twelve hallucinating cases have had temporal lobe atrophy or aplasia. One of the three cases had ample microscopic changes in the temporal lobes, one was clinically somewhat doubtful, and in fine, only one of the twelve hallucinating cases could be safely said to have neither gross lesions nor important microscopic lesions in the temporal area.

To sum up, then, we expect frontal lobe lesions in cases of delusion formation, provided that the delusion formation is not of the fantastic and overimaginative sort, whereupon parietal lesions would be expected. We expect parietal lesions associated with catatonic symptoms; we expect temporal lobe lesions in cases of auditory hallucinosis.

Accordingly, I have collected the microscopic data in the four cases at present under discussion under these heads, — frontal, parietal and temporal. For convenience I have divided the cortex into three portions, — frontal, parieto-occipital and temporo-occipital. The following table indicates the extent of nerve-cell loss and of neuroglia proliferation separately in the three regions mentioned: —

	I (10.9), 14 Years.	II (12.41), 10 Years.	III (12.47), 2 Years.	IV (11.36), 20 Months.
Frontal loci,	9	9	9	6
Nerve-cell losses,	5	44	35	34
Neuroglia proliferation,	7	8	4	3
Parieto-occipital loci,	10	9	10	7
Nerve-cell losses,	17	47	54	19
Neuroglia proliferation,	8	3	2	8
Temporo-sphenoidal loci,	10	10	10	6
Nerve-cell losses,	9	48	50	25
Neuroglia proliferation,	5	9	1	–

It is clear from inspection of the table that Case I (10.9) stands out as a case in which the parenchymal disease is especially parieto-occipital, since in ten loci, seventeen instances of nerve-cell losses in different layers were found. Here, then, should be a case with catatonia, unless, perchance, the lesions in the parieto-occipital area should be exquisitely occipital and not affect kinæsthetic areas. In point of fact, the lesions enumerated are all in the post central, superior and inferior parietal areas, and are especially marked in the inferior part of the post central gyrus and in the superior parietal region on both sides.

This patient was one who developed characteristic catatonic symptoms, including cerea flexibilitas and attitudinizing in the last two years of her life. She also had auditory hallucinosis and showed, as the table indicates, a number of parenchymal losses in the proper area, especially the superior temporal gyrus. Both the parietal and the temporal lesions were largely infracortical in distribution, in accord with the argument mentioned above as to the infracortical origin of catatonia and hallucinosis. It will be noticed from the table that there were comparatively few lesions in the frontal region. The case was one of delusions of jealousy, and might have been expected to have shown frontal lesions which, however, were not greatly in evidence. However, upon closer analysis of the delusions it will be found that they are of a synthetic character and not of a schizophrenic character. They are quasi-normal, and it is not easy to conceive just what histological basis such delusions ought to have. At all events, none of any consequence were found, and the frontal region remains practically destitute of any parenchymal loss, and has exceedingly slight evidence of gliosis. Accordingly, we may suppose that we are getting histological evidence in this case merely of the terminal hallucinosis and catatonia, and not of the essential paranoia of the patient.

If we turn to Case II (12.41) we find a totally different situation. The amount of parenchymal loss, as indicated by the number of loci, is far larger than in Case I (10.9). In fact, there are four times as many loci affected, and the lesions are scattered throughout all three regions, — frontal, parietal and temporal. There are relatively more parenchymal losses in the frontal region than in the temporal region, and relatively more in the temporal region than in the parietal region.

If we took these data on their face value we should say that this case ought to be predominantly delusional but also hallucinatory and catatonic. There was some question whether the patient was not slightly feeble-minded to start with. However, her command of theological verbiage was large, and she was always self-supporting up to the time of her psychosis. My point in mentioning this query is that very possibly some of the parenchymal losses are actually due to an initial lack of cells.

The interpretation of an initial lack of cells in any of these areas would of course look in a different direction. An initial lack in frontal cells might not at all suggest delusional tendencies; an initial lack of superior temporal cells likewise might have nothing to do with auditory hallucinosis; and a simple parietal mechanism would not necessarily entail disorders of kinæsthesia with the projection of catatonia. But taking the parenchymal deficiency as signifying initial loss, let us inquire what the symptoms of this case are. Was it predominantly delusional? She showed hallucinations of a doubtful but probably hypnogogic visual nature. It is not clear that she ever had auditory hallucinations. The appearance of parenchymal loss has proceeded in all these areas to a marked degree, so marked, in fact, that it is rather surprising that there was no gross evidence of brain atrophy (the brain weighed 1,130 grams, possibly a slight reduction from the normal weight; the patient was cardiac, and there was such a condition of infiltration of the brain tissue that we can *post hoc* readily believe the brain was slightly and diffusely swollen). In short, the lesions in this brain are so numerous and widespread and so affect both the supracortical and the infracortical regions that correlations of the nature here attempted are impossible. One can find a correlation between almost any symptoms and some properly situated lesion in this case. The patient was deluded, hallucinated and catatonic, and had frontal, temporal and parietal lesions.

Let us, for the sake of argument, regard the frontal lobe delusion correlation as established; let us regard the parieto-occipital correlation with "feelings of being hypnotized;" and the "black cat's jumping over a pitcher" as indicators of disease in the parieto-occipital or occipital areas. How, then, shall we interpret the absence of auditory hallucinations? Without invoking the poverty of clinical observation, and the fact that the patient may have kept auditory hallucinations to herself (she was, in point of fact, often engaged in vituperative language, some of which may have been of hallucinatory origin or of a responsive nature), we must be interested in the fact that some of the temporal lesions shown are exceedingly heavy, and affect both the supracortex and the infracortex. Suppose infracortical, temporal lobe lesions of a nature suitable to produce hallucinations (we are still ignorant just what sort of lesion ought to produce hallucinations), would it be too speculative to suggest that the co-existence of severe supracortical lesions might still interfere with the proper combination and abstraction of the infracortical data in such wise as to produce conscious hallucinations? That is to say, the total supracortical and infracortical mechanism may be conceived to be so altered that though the conditions for hallucinosis are present in the infracortical zone, the hallucinations are not purveyed through lack of finer connections with the higher psychic apparatus mediated by the supracortical layers. Naturally I do not wish to claim more than speculative value for such considerations. It is along these lines, however, that I feel much important correlation will be performed in future.

If we inspect the table of local distribution of lesions in Case III (12.47) we find conditions approximating those of Case II (12.41), although the duration of Case III is far less than that of Case II. We find here that the parieto-occipital region has numerous lesions slightly in excess of lesions, also numerous, in the frontal and temporal areas. The case was a catatonic one, and, in fact, showed both cerea flexibilitas and catatonic stupor, and would probably be classified as a case of catatonic dementia præcox. It appeared that she had auditory hallucinations which she tried to keep out by covering her head with her arms, but the content of these hallucinations was never made out. An attitude of apprehensiveness, an early phase in which she constantly repeated the words "Father Patterson," "Father Patterson," led us to the idea that she had delusions of persecution, or else that she was extremely apprehensive and threw a delusional covering over everyday features of the environment. The most pronounced regions of cell loss were in the infracortical portions of the parietal and temporal regions.

When we come to the analysis of Case IV (11.36) we find that the parieto-occipital lesions are far fewer in number, and that the case is more one of losses in the frontal and temporo-sphenoidal areas. This case, therefore, should show delusions and possibly auditory hallucinations. She never showed convincing catatonic symptoms, although she showed a marked mania and hyperkinesis somewhat suggestive of manic-depressive psychosis. She showed characteristic auditory hallucinosis, and it appears that most of her anti-social acts of a mischievous and silly nature were based upon these hallucinations. That she showed definite delusions, *e.g.*, of persecution or of poisoning, is doubtful. We know little of her history immediately after the onset of mental symptoms which followed confinement in a hospital for consumptives. Throughout her period of observation in a hospital for the insane she showed elation, erotism, mischievousness and silliness somewhat suggestive of manic-depressive psychosis, and again somewhat suggestive of the elation of certain paretics. The cell losses in frontal region were numerous and both supracortical and infracortical in distribution. It is interesting that of all four cases this one was the case which showed a marked myelin sheath disorder, — a disorder so marked as somewhat to suggest the disappearance of fibers in paresis. The supraradiary fibers were absent in all the frontal regions examined, and there was a thinning of fibers in the white matter underneath. In short, the disorder in this case was much more than a fine disorder of minor cell mechanisms, and approached the more general disorder of paresis. Upon some such lines I would be tempted to try to explain the absence of definite delusions, except those based upon hallucinations and irritability. I should be tempted to regard the frontal lobe lesions as of such degree that we might think of the case as one that had lost its frontal inhibitions. At the same time, it must be remembered that no coarse atrophy of the brain had supervened, unless we regard the brain weight — 1,140 grams — as demonstrating brain atrophy.[1]

SUMMARY.

Thanks to the work of Elliot Smith, Bolton, Campbell, Brodmann, Ramon y Cajal and others, the neuropathologist can now afford to attempt finer functional correlations in the field of mental diseases, thus aiding in the problems of microlocalization. The anti-localization tendencies of the Wundtians, and the interest in merely logical categories taken by Freudians, should not interfere with progress in microlocalization. Dementia præcox, for example, can be called a matter of maladaptation of the patient to his environment, or of the patient to himself, and also a disease characterized by cortical changes.

Previous work had shown anomalies in a high proportion of dementia præcox brains, and in a corresponding low proportion of the brains of manic-depressive subjects. These anomalies may well be interpreted as weak places in these dementia præcox brains, and the brains, in fact, are apt to show scleroses and atrophic processes over and above the anomalies. But certain perfectly normal-looking brains in dementia præcox also show the same microscopic changes in lesser degrees than are found in the anomalous sclerotic and atrophic brains. The problem of the present communication has been to work out the focality of these microscopic lesions in a few normal-looking brains studied with unusual intensiveness. In the same series of brains, work of previous series had shown a dissociation of parenchymatous (neuronic) and interstitial (neuroglia) changes, indicating a tendency on the part of cortex pathology to resemble the pathology of the kidney. But the majority of brains show mixtures of the parenchymatous (neuronic) and the interstitial (neuroglia) lesions. Recent work in comparative anatomy indicates the rather fundamental importance of distinguishing the functions of the upper cortical layers (what may be called the supracortex) from the functions of the lower cortical layers (what may be called the infracortex). The finer processes of mental dissociation (schizophrenia) ought to be correlated with lesions of the supracortex, and such lesions were found in cases with evidence of schizophrenia.

On the other hand, in a case of delusions characterized by no splitting (schizophrenia) whatever, but rather by a process of overelaborate synthesis, there was no evidence of supracortical disorder, and, in fact, no proposal can be made for the histological correlate with this process of oversynthesis.

Other processes equally characteristic of dementia præcox, but logically far simpler in their make-up, such as auditory hallucinosis and muscular hypertension (catatonia), received suggestive correlation with processes in the lower layers of the temporal and parietal regions, respectively.

As far as the tissues of these four cases go there is little or nothing inconsistent in the finding of the hypothesis that ordinary (non-fantastic) delusions are correlated rather with frontal than with otherwise situated lesions; but the supracortical type of delusions found in certain long-standing paranoiacs, whose fine mental processes run in a quasi-normal manner, find no special correlation in any region, and the probable importance of the solution of this problem remains obscure.

As for auditory hallucinosis the work seems to afford the expected correlation with temporal lesions. In one case, however, temporal lesions of considerable severity were attended in life by hallucinations of hearing, but in this case there was also a severe supracortical disease of the temporal region, and it may be that for the production of hallucinations some congress is necessary between the activation of the supracortex and infracortex, respectively.

In previous work on this series the brains had indicated a post central and superior parietal correlation for catatonia whose muscular hypertension was accordingly regarded as very possibly a kind of morbid kinæsthesia. Present work suggests that the anatomical correlate is not merely to the post central and parietal regions, but still more specifically to the infracortical parts of these regions.

It may be suggested that the lesions found in samples of tissue in the post central, superior parietal, inferior parietal and superior temporal regions indicate a certain systemic tendency in the underlying processes, for these lesions were bilateral, and occurred, as it were, in two continuous sheets of tissue on both flanks of the brain in one of the best defined of our cases; these flank lesions were not attended by any similar lesions of the frontal, precentral, occipital and lower temporal and smell regions. The nature of a process which could mildly affect nerve cells and neuroglia on two sides of the brain, and also specially affect the infracortical rather than the supracortical portions of these affected sheets of tissue, remains a mystery. It is perhaps no greater mystery than that which attends the distribution of lesions in the spinal cord of pernicious anemia, or the fine symmetrical lesions of multiple sclerosis in the spinal cord. It remains unsettled whether these lesions are secondary in point of time to a non-cell-destructive phase in the disease, or whether the lesions of which these microscopic effects are indicators began *pari passu* with the symptoms; that is, it remains a question whether we are dealing with the excess wear-and-tear process of cell mechanisms morbidly employed, or whether the morbidity of neural function is an exact equivalent of the neuronic and neuroglia morbidity.

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THE DIFFERENTIATION OF PSYCHOTIC FROM NEUROTIC CONDITIONS.*

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In Tuke's "Dictionary of Psychological Medicine," published in 1892, are found these definitions: "Psychosis, — a mental affection; psychoneurosis, — a mental disease."

To be sure, these definitions are many years old, and since then the situation has been somewhat clarified, but to many practitioners and laymen the clinical differentiation of psychotic from neurotic conditions remains about as nebulous as the above-quoted definitions.

A part of this vagueness of understanding has been due to the relationship between psychoses and insanity, but this difficulty is resolved by recognizing that insanity is a social condition, — a question of conduct in a given environment, and a question primarily of legal rather than medical definition. It need hardly be stated that many people are adjudged insane who have no psychoses, while many psychotic individuals are never judged insane. Many a wild hysteric has been committed as insane, and rightly, because of his or her conduct, but not because of suffering from a psychosis; and many a senile dement has been lovingly cared for at home as a sweet old grandmother. Clinically, we are familiar with the diagnosis of pre-dementia præcox and paresis sine paresi in individuals whose conduct does not at the time warrant commitment as insane.

The matter of insanity, then, must be considered apart from that of the existence of a psychosis, for insanity, as has often been stated in court, can be described but cannot be defined. In fact, Lord Justice Blackburn is quoted by Church and Peterson as saying, regarding insanity: "I have read every definition which I could meet with, and never was satisfied with one of them, and have endeavored in vain to make one satisfactory to myself. I verily believe that it is not in human power to do so."

The differentiation of a psychosis from a neurosis is, however, a matter of prime importance and worthy of discussion. To the layman a vast gulf divides the psychotic from the "only nervous." He will go to the psychopathic hospital readily, but cannot be dragged to a State institution. He will go to a nervine hospital, but hesitates even to pass by a sanitarium for mental cases. His sick neighbors are perhaps at times insane, but his own relatives are only "very nervous." He will consult a neurologist, but hesitates to call on a psychiatrist. The family practitioner prefers to consider a case "nervous," whereas the psychiatrist may often remind one of the old Quaker who is famed for saying, "Every one is queer but me and thee, and sometimes thee is a little queer."

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* Read at the meeting of the Boston Society of Psychiatry and Neurology, Oct. 18, 1917.

Surely some clinical standard should be found that will help clarify this situation.

In alcoholic intoxication the law has recognized the distinction between delirium tremens and alcoholic hallucinoses, and provides for the exclusion of the former and the admission of the latter to the Boston Psychopathic Hospital.

Kræpelin has given a table for differentiating these two conditions, in which ten factors are considered, as follows: Lucidity and orientation are absent in delirium tremens, present in alcoholic hallucinoses. The sensorium is clouded in the former, clear in the latter. Hallucinations are largely of sight in tremens and of hearing in alcoholic hallucinoses. Suggestibility is increased in the former, normal in the latter. Restlessness is increased in tremens, absent in the other condition. Consistent delusions are absent in tremens and present in alcoholic hallucinoses. Coarse tremor is present in the first condition, absent in the second. The course of the disease is rapid in tremens and slow in alcoholic hallucinoses, and the termination of the former is by crisis and of the latter by lysis.

In other words, as a general thing, in delirium tremens there is evidence of a toxic interference with the receipt of stimuli and an increased reaction through the vegetative nervous system to emotional stimuli, whereas in alcoholic hallucinoses the evidence of interference with the receipt of stimuli is seemingly lacking, and instead of an increased reaction through the vegetative nervous system to emotional stimuli there is often a striking lack of such reaction.

A similar distinction can be seen in cases where another toxic agent is at work, namely, syphilis. In pre-paretic cases the symptoms suggest neurasthenia, and exhibit an increased reaction through the vegetative nervous system to emotional stimuli, whereas in full-blown paresis there is again a striking lack of such reaction.

In addition to alcohol and syphilis a third agent that reacts upon the body with symptoms varying through the whole gamut of neurotic and psychotic conditions is one upon which much interest and investigation is now focused, namely, shell shock.

Here, then, are found a chemical agency, a microbic agency, and a purely physical agency, each of which produces in man symptoms varying from mild neuroses to severe psychoses.

Study of this new agency, namely, shell shock, promises new and invaluable knowledge in the fields of physiology, and especially psychiatry.

In a recent article on "The Psychology of Fear," Sir Robert Armstrong-Jones has written most illuminatingly upon the subject. At the risk of boring those of you who have read his article, a short abstract of some of the knowledge and theories that he has presented will be given. He states "that in every emotion there is a cognitive and active and an affective experience, and that the emotions are the expression of — or, according to some, are themselves expressed in — characteristic instinctive acts." Fear, which in its various forms is a universal and fundamental human experience, is expressed physiologically in varying degrees by inhibition of all visceral movements, contraction of the blood vessels, lowering of surface temperature, sweating, cessation of the flow of saliva, dilatation of the pupils, erection of the hair, increased cardiac and respiratory activity, and tremblings and twitchings of muscles, especially of the face. In addition to these direct emotional reactions, through the vegetative nervous system, there is an indirect action through stimulation of the adrenal glands that results in an increased sugar excretion from the liver into the blood for the use of the muscles, a diversion of blood from the abdominal viscera into the heart, lungs and central nervous system, an increased coagulability of the blood, and an increased blood pressure. This adrenal secretion augments the effect of the emotions, and also helps to prolong and sustain it, and may be likened crudely to the ignition in an automobile, which at first is accomplished by the battery, and then prolonged by the action of the magneto.

Such, according to our present knowledge of physiology, is the mechanism of the relationship between emotional activity and physical reflex action.

In shell shock it has been suggested that, owing to the intensity of the emotional stimuli, a dissociation of the cerebrospinal and the vegetative nervous systems takes place, resulting in uncontrolled and unregulated action of organs innervated by the autonomic system.

The following thesis is advanced for consideration. In the neuroses, neurasthenia, psychasthenia, hysteria, etc., there is a hyper-reactivity through the vegetative nervous system to emotional stimuli, whereas in the psychoses there is a hypo-reactivity through this system to such stimuli.

The following observations and cases are quoted to illustrate this thesis: —

In the syphilo-psychoses (the mental disease groups which have been suggested by Dr. Southard will be considered) there are recognized the syphilitic neurasthenics, the pre-paretics, the cases of paresis sine paresi and the paretics.

Case A. — A case of neurasthenic syphilis, who complained of being "all in." "Could not think." Did not want to go home to his family, too nervous to stay at his office. Admitted luetic infection several years previous, and had had thorough treatment under skilled hands. Physical examination showed increased reflexes, healed ulcers over the shins, and a general hypersensitiveness to emotional stimulation. Appetite and sleep poor. Bowels sluggish. With rest, baths and psychotherapy he gained in weight and poise, and has been able to conduct his business for several years with marked success.

Case B came to the out-patient department of the Psychopathic Hospital because when he got out of bed he could not put one foot readily into his slipper. His speech was slightly thickened and his pupils sluggish and irregular. He was referred to the hospital for observation, where all laboratory tests were found positive for paresis.

Case C complained of inability to concentrate his mind. Did not feel well. Worried over an inability to pronounce certain words clearly. Was restless, anxious about every physical symptom. Physical examination showed almost absent knee jerks, irregular pupils that usually failed to react to light. Laboratory tests were positive for general paresis. With intravenous salvarsan, baths and psychotherapy he improved in physical condition, and seemingly became able to enunciate more clearly. He lost many of his worries and returned home in much better shape. When last seen he was not committable, and could scarcely be classed as psychotic, although from the laboratory point of view a clear case of paresis.

A typical case of paresis need not be cited, as the changed affectivity is recognized as an early symptom almost always present. The common immunity of the paretic to unpleasant after-effects from lumbar puncture is recognized, and when a case has nausea, headache or dizziness after a lumbar puncture a positive Wassermann reaction is not expected.

In the hypo-phrenoses — the feeble-minded — keenness of reaction to emotional stimuli is not expected. In case of fire at a feeble-minded school it has been remarked that the patients are less liable to be panic-stricken than the nurses and attendants.

Case D. — A young man seen in the out-patient department of the Psychopathic Hospital. He was so cheerful and well nourished and emotionally placid, in spite of a series of major operations of doing and undoing a gastro-enterostomy, repairing a hernia, and breaking up abdominal adhesions, performed at the Massachusetts General, the Carney, and the Brigham hospitals, that he was given a Binet test and proved to be but nine years of age mentally.

Case E. — A high-grade moron of gluttonous habits, who insists on constantly overeating. Often after excessive eating he will easily regurgitate part of his meal with as little discomfort as an overturned bottle.

Among the epileptoses a change in affectivity is noted that may gradually develop and remain present, or may precede or follow individual seizures.

Case F. — A woman, eighty years of age, who since childhood has had epileptic attacks varying in frequency from none to fifteen a week. Within the past twelve years she has gradually developed a psychotic condition, and now shows almost complete lack of memory, and at times confusion and irritability. Her mother, herself, her daughter and her grandmother have suffered from epilepsy. Now that her psychotic condition has developed she is placid and cheerful most of the time, going driving daily, and has shown practically no physical enfeeblement within the past five years.

Among the pharmaco-psychoses — the alcoholic and drug cases — the distinction between delirium tremens and alcoholic hallucinoses has already been considered.

Among the encephalo-psychoses — the coarse brain disease cases — are to be found cases that in their early stages are classed as neurasthenics that later show marked changes in affectivity.

The somato-psychoses are seldom seen in their initial stages by psychiatrists. Experienced general practitioners, however, recognize in typhoid, cardiac, pneumonic and puerperal cases a change in affectivity, a keen alertness, a disregard of normal physical weakness and disabling symptoms that put them on their guard to prevent sudden elopement or tragedy. Osler states in his "Practice of Medicine" that acute mania occurs as a complication of various somatic conditions, but gives no hint to assist a practitioner in recognizing the onset of such a condition.

Case G. — A case of marked cardiac decompensation. If unwatched he would spring out of bed and run out of his room, and show evidence of strength and agility absolutely incompatible with his physical condition.

Among the gerio-psychoses are again to be found cases varying in symptoms from neurasthenias to frank psychoses. Affectivity changes are an early symptom of psychotic change, and the virility and endurance of senile dements often far surpass that of non-psychotic elders.

Case H. — A woman of nearly eighty years, blind, deaf, toothless and partly crippled with arthritis, has often required two or three nurses to hold her when her nails have to be manicured.

Case I. — A man of seventy-five, who had not eaten of his own volition for months, requires two strong male nurses and a doctor when he is tube fed.

Among the schizo-phrenoses — the dementia præcox cases — change in affectivity is an early and almost constant symptom. In fact, it may be suggested that "the shut-in personality" may possibly better be thought of as a "shut-off personality," an individual in whom the connection between emotional stimuli and normal reaction through the vegetative nervous system is irregular and labile, predisposed to rupture under environmental or physical strain.

Case J. — A woman of thirty-five, a dementia præcox case of several years' standing, who required the removal of several old teeth. She was seized, heavily etherized, and had four teeth extracted. When seen a quarter of an hour later she was sitting on the edge of her bed, asking to go out into the garden, and showing no nausea or evidence of shock from her uncomfortable experience.

The cyclo-thymoses — the manic-depressive cases — also show types varying in symptoms from mild neurasthenic-like depressions to frank psychoses.

These cases imperatively call for an early diagnosis, for from among these cases come the sudden suicides and maniacal murders. When the hard-working business man or military officer, with heavy cares and responsibilities, ceases to be fatigued by excessive labor, craves more work, less sleep, and is indifferent to nourishment, danger should be scented and relief from emotional strain secured.

Among the frankly maniacal cases, excessive motor activity, without apparent fatigue or need of sleep, is often marked. Exposure of the person to cold and wet seldom, if ever, results in colds or reflex congestion of the nasal mucous membranes.

Case K. — A woman of sixty, who had usually suffered from frequent colds and so-called "hay fever," upon the development of a prolonged agitated depression ceased to have any signs or symptoms of such vasomotor disturbance. She also failed to show any nausea or evidence of shock after being heavily etherized.

Case L. — An elderly woman who had suffered for years from asthmatic attacks ceased abruptly to have these attacks subsequent to the onset of a long depression.

Among the psychoneuroses there is universally recognized a relationship between emotional disturbances and the physical symptoms that, to a greater or less degree, incapacitate them for effective life and happiness. In the neurasthenias these symptoms seemingly represent excessive reactions through the vegetative nervous system in the field innervated thereby, — the digestive system, the urinary organs, the genital organs, the respiratory apparatus, the cardio-vascular system, etc., while in hysterics and shell shock cases there is seemingly an overflow of reflex stimulation that, in addition, inhibits various muscular activities usually controlled through the cerebrospinal system.

The scope of this paper does not permit of a discussion of the etiology of the psychoneuroses. That the emotions play an important part in these conditions is generally admitted. That the emotions react physiologically through the vegetative nervous system is also admitted. That recognition by a patient of this reaction through the vegetative nervous system gives rise to secondary emotions, and that these secondary emotions start a secondary reaction, and so on, with the formation of a vicious circle that becomes more and more complex the longer it spins, is also recognized.

Whether the genesis of the emotional disturbance is due to intra-uterine or extra-uterine sex trauma, to buried complexes, or due to congenital somatic deficiencies; whether the type or intensity of the stimulus, or the congenital or acquired weakness of the patient is the determining etiological factor, — all this is aside from the scope of this paper.

Among the psycho-pathoses — the psychopathic individuals — there may be assumed to be a lability of connection between emotional activity and the vegetative nervous system that in the genius enables him to surmount difficulties with exceptional success, and disregard the distractions and environmental inhibitions of more common individuals, — a lability which in another member of the same family, with failure, predisposes to mental disease.

CONCLUSIONS.

No attempt has been made to define insanity, which may properly be considered capable of description, but not of definition.

No attempt has been made to consider the etiology of various types of psychoses.

The suggestion is made that clarity of diagnosis will be furthered and consequently great help rendered in prognosis and treatment if a clear line of demarkation can be drawn between the psychoses and the neuroses; that cases of whatever etiology — alcoholic, syphilitic, determined or undetermined — be considered neuroses so long as they show hyperactivity of reaction through the vegetative nervous system to emotional stimuli, but that they be considered psychoses when there is found to exist evidence of hypo-activity of reaction through the vegetative nervous system to adequate emotional stimuli.

THE TREATMENT OF EARLY SYPHILIS IN RELATION TO THE DEVELOPMENT OF NEUROSYPHILIS.*

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Modern work on the treatment of general paresis, such as that of Solomon at this hospital, has clearly shown that there are cases which for some as yet unknown reason do not improve; or, if they improve, relapses are early and marked. Similarly there are cases in which vigorous treatment in the early stages of syphilis will not prevent the later development of paresis.

The difficulty of obtaining from cases of neurosyphilis accurate histories regarding syphilitic infection and symptoms is well known. Still less often are we able to obtain any accurate information regarding the precise amount and character of antisyphilitic treatment at the time of infection. Accordingly, the cases reported here should be of general interest because of the known amount and character of the treatment. A further interesting and suggestive point lies in the results of the type of treatment developed and applied by Solomon. This seems to me to carry a wholesome therapeutic lesson.

Case I. — A male, age 28, came voluntarily to the hospital Dec. 11, 1916, complaining of loss of memory, speech difficulty and irritability, all developed within the six months just past. He was tidy, elated, showed a mild memory defect, was somewhat silly, over-emotional; circumstantial; rather wandering in his attention, and had a speech defect. Physical examination was not remarkable except pupils unequal, irregular and react sluggishly; tendon reflexes hyperactive; no sensory disturbance or ataxia.

Six years previously he had a chancre. During five years he received almost continuous treatment with mercury by injection. He had two injections of salvarsan. He never received any potassium iodide. He never showed any secondary symptoms.

Laboratory Findings. — Blood and fluid Wassermann reaction positive. Spinal fluid showed: globulin, 3; albumin, 4; cells, 34; and a gold reading of 5555431000.

In twelve days he received four injections, totaling 2.3 grams of diarsenol. He was then discharged to the out-patient department, where treatment was continued, so that on Feb. 14, 1917, the Wassermann

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reaction on the blood serum was negative, and the spinal fluid showed: globulin, 2; albumin, 3; cells, 4; gold reading, 2222210000. In the meantime there had been great physical and mental improvement. At the present time he shows slight tremors; a little stumbling on test phrases, but his ordinary speech is clear and accurate; his memory is good; and his insight into his past illness is good.

This case presented a clinical symptom-complex typical of paresis in its early stages coming on six years after the initial lesion, and after five years of rather intensive treatment. He has shown marked improvement under the type of treatment which has produced the best results in paresis, but the favorable time for such intensive treatment was months or even years ago, before the changes in the nervous system had advanced to any degree of degeneration.

Case II. — A male, age 34, came voluntarily to the hospital May 7, 1917, complaining that for about six months he had been tired, irritable and nervous, and was getting worse. He also recognized a memory loss. He worked in a post office at night and had spent his days for two years as a medical student. Normally ambitious and a hard worker he had worried a great deal over his condition; had become emotionally unstable, crying readily, depressed and showing memory loss. Aside from exaggeration of the knee jerks, and a very slight speech defect, the physical examination was negative.

He had a chancre three years ago. After the secondary symptoms appeared he received thorough and intensive treatment with salvarsan, mercury and potassium iodide. Mercury and potassium iodide have been carried in courses up to the time of admission. Of late he has been troubled a great deal by headaches. A part of his difficulty in medical school, where he did not do very well, may have been due to the spirochetal invasion of the central nervous system, though undoubtedly much of it was due to his combinations of work.

Laboratory Findings. — Wassermann reaction on the blood and fluid positive. The spinal fluid showed: globulin, 2; albumin, 2; cells, 8; and a gold reading of 5554332100. Under intensive treatment of the usual type his mental and physical condition improved very markedly, and on July 21 the spinal fluid showed: globulin, 0; albumin, 0; cells, 0; gold, negative.

At the present time, aside from slight memory loss and some slowing in his work, his condition is very good.

Case III. — A male, age 43, was brought to the hospital by the police on Aug. 16, 1916. He was then in a highly excited state, grandiose and talkative. On examination he was oriented; active; euphoric; voluble; there was some flight of ideas; and he had no insight.

Physical Examination. — The pupils were unequal, irregular, Argyll-Robertson in type; the tendon reflexes were absent; there was some inco-ordination; he had a high blood pressure.

At twenty-seven, sixteen years ago, he had a chancre. During the succeeding ten years he was treated almost continually with mercury and iodide. The principal reason for this was the frequent recurrence of skin symptoms. When salvarsan was introduced he was among the first in Boston to receive it. With this treatment his skin lesions healed. Then for six years treatment was not so intensive. Despite all of this treatment, and the marked skin lesions (which are sometimes supposed to argue against the later development of neurosyphilis), he eventually developed paresis. Under intensive treatment he improved sufficiently to go on a visit in November, remaining out for a year. He was then returned in a maniacal state, having refused treatment for six months before readmission.

At the time of his first admission the laboratory findings were: blood and spinal fluid Wassermann reaction positive. The spinal fluid showed: globulin, 3; albumin, 2; cells, 8; and a gold reading of 5555432100.

Despite the clinical improvement under treatment the spinal fluid always remained positive to the various tests.

These cases do not add much to the solution of the important theoretical and practical question, "Why does any syphilitic have neurosyphilis?" but they do demonstrate the fact that, either because of special invasive powers or increased susceptibility of the nervous system, neurosyphilis may develop despite thorough remedial measures. They show very clearly that it is not a question of time interval after infection, or after cessation of treatment, since the interval between infection and paresis was three, six and sixteen years, respectively.

These cases bring sharply to the fore a question concerning the duty of the syphilographer to his patient. It is my belief that before being discharged from treatment, all syphilitics should have lumbar puncture to determine the condition of the spinal fluid. Certainly all patients who suffer much from headache, or show any neurologic or mental changes, however slight, should be punctured. If the fluid tests are positive, then treatment should be modified accordingly. Furthermore, if intensive treatment of the patient after paresis has developed will bring about an improvement, then intensive treatment is certainly indicated in all cases showing any changes in the spinal fluid, and the spinal fluid findings should be the guide in further treatment.

CONCLUSIONS.

Thorough early treatment is not a guarantee against later paresis. The time interval between infection and development of paresis is not especially modified by the usual treatment. Whether due to special invasive powers, lack of resistance in the nervous system, or drug-fastness of the organism, the fact remains that there are cases in which the most vigorous treatment fails to prevent the development of paresis, or even to delay it.

Patients in the secondary stages should be punctured, and treatment modified according to spinal fluid findings. If not all patients, then certainly all early syphilitics with headache or any nervous or mental symptoms should be punctured.

If intensive treatment will improve the patient who has developed paresis, then intensive treatment of the same type months or years before, guided by spinal fluid findings, should go far towards preventing the later development of paresis.

REPORT OF TWO CASES OF PARESIS WITH MENTAL PICTURE OF DEMENTIA PRÆCOX.

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The following cases are unusual from the fact that they presented serological findings of paresis with mental pictures of dementia præcox. In fact, one was diagnosed as dementia præcox before Wassermann test was made on the blood and fluid, which test was made simply as a routine procedure and not because paresis was suspected in this case.

CASE No. 1 (MISS I. S.). — This case is that of a young woman who was transferred to the Grafton State Hospital Nov. 25, 1914, from another State hospital whose abstract shows the following: admitted there July 5, 1914; female, age thirty-one; divorced (?); occupation, prostitute. Her history was very meager. Her father had lost track of her for twelve years till a week prior to admission. Her mother died when the patient was a baby, and her father married again. She was always a headstrong child, and always caused them trouble on account of her fondness for the opposite sex. When seventeen years of age she left home, going to New York, and lived the life of a prostitute. A week before admission her relatives were notified to come for her, this being the first news they had of her for almost eight years. She was brought to her father's home, and for several days was confused, talkative, hallucinated and in great fear. On admission she was almost mute, resistive and confused. The medical certificate on admission states that the eyes did not react to light, but examination at hospital showed them to appear normal. All reflexes were exaggerated, co-ordination was good and Romberg's sign not present. She remained catatonic all the time while there; was fed with a spoon; made irrelevant replies to questions; lay in bed without moving; was quite resistive and untidy.

Diagnosis. — Dementia præcox, catatonic. She was admitted to Grafton State Hospital Nov. 25, 1914, having been transferred from the hospital above referred to.

Examination showed the reflexes to be slightly exaggerated, with normal pupils. She had coarse tremors of eyelids and hands, no impairment of gait, and co-ordination tests were fairly well performed in spite of the fact that the patient was rather weak. She showed some swaying in Romberg position, also evident decrease of temperature-sensation of lower limbs.

Mental examination showed a young woman of slight stature, presenting a demented, disheveled appearance, and rather vacant facial expression, catatonic at times. She made no voluntary conversation, but would answer questions after much persuasion with no evident speech defect. It was difficult to get and hold her attention. There was marked amnesia present. She could not recall her age, where or when she was born, or anything of a similar nature. On account of the psychomotor retardation and apparent dementia the presence of illusions, hallucinations and delusions could not be obtained. There was some emotional disturbance and she would cry when questioned. She was very untidy and slack in appearance, took no interest in things going on about her, and needed very close care and attention.

During the first few months at the hospital she remained in the same apparently demented condition, — semi-mute, untidy and filthy, — although she improved somewhat physically, ate voluntarily and gained in flesh.

At this time there was made a routine Wassermann test of the blood of all of our old cases in the hospital and we found her blood to be positive; accordingly, a Wassermann test of her spinal fluid was made which showed: cells, 4; small lymph, 75 per cent.; large lymph, 25 per cent.; globulin, ++; albumin, +; gold, 555540000.

She was put on mercuric chloride intravenously for a time. A short time after she showed some improvement, both physically and mentally, took better care of herself, talked more and appeared much brighter.

Another Wassermann examination of blood and spinal fluid was made Aug. 1, 1916, both being positive. The fluid gave the gold, 55555432; cells, 23; albumin, +++; globulin, +++; small lymph, 88; large lymph, 8; plasma, 4. She was put on treatment of salicylate of mercury and diarsenol periodically at this time, and the blood and fluid were examined from time to time, always proving positive. The last examination of the fluid, January, 1917, showed gold, 5355555433.

To summarize: this patient showed semi-mutism, apparent dementia, catatonic symptoms, untidiness, amnesia, inactivity and psychomotor retardation, with constant positive serology of paresis, exaggerated reflexes and tremor.

At the present time she shows considerable mental and physical improvement over her condition at the time of her admission, but still with much retardation, with hyperactive knee jerks, very stiff pupils, marked tremor of tongue and fingers and positive Romberg.

Case No. 2. (Mr. J. D.). — Admitted to the Grafton State Hospital Nov. 23, 1915, from another State hospital whose abstract is as follows: admitted there March 27, 1915, male, age 37, single.

Owing to his demented and retarded condition has preserved a state of mutism during greater part of his residence here, and it has been impossible to obtain any information from him in regard to his relatives and friends. He was arrested by the police and admitted to this hospital on the following certificate.

"Onset of attack unknown. He was arrested by police March 24, 1915, for his mental observation. Talked irrelevantly and seemed to be in a moody, depressed mental condition. Says people have not used him right, and talks of suicide. Has torn up furniture of his cell, and on two occasions has attempted to kill himself. No history of drugs or alcohol."

On admission to hospital patient was quiet, orderly, mute and showed decided psychomotor retardation. Throughout his stay in this hospital he has shown a blank, expressionless apathetic countenance, but states he does not feel exceptionally blue. On one occasion showed some ideas of persecution. Has evidently been hallucinated at times. Spoke of seeing faces and various animals, especially at night. He showed partial insight. Patient gradually became much more demented and mute, refusing to answer all questions, and showed very limited mental activity.

Physical examination negative. Wassermann reaction to blood and spinal fluid positive. Urine negative. Pupils react well to light and accommodation. Patient does not react to pin pricks. Knee jerks are diminished equally. Triceps present. Organic reflexes not impaired. Later, however, the patient showed incontinence. There was some swaying in Romberg position with some tremor of extended fingers. Patient was quite restless and resistive at times.

During the remaining time of his residence at this hospital he was mute, was observed staring constantly at the floor, looking neither to the left nor right. He was fairly clean and neat in his personal appearance. He would obey commands slowly, but owing to his retardation and increasing dementia would not speak or co-operate.

On admission to the Grafton State Hospital Nov. 23, 1915, the physical examination was negative other than mitral murmur. Superficial reflexes were present and acute. Knee jerks were sluggish but equal. No clonus or Babinski. Pupils reacted sluggishly to light, and accommodation with consensual absent. His gait was slow, but otherwise showed no peculiarity. He stood steady in Romberg position.

Mental Examination. — He sat with his head resting upon his chest with his hands clasped, paid no attention to questions, and was entirely indifferent to his surroundings. He was extremely feeble in his movements, walked slowly about, was careless about his personal appearance and untidy in his habits. On account of his mutism, illusions, hallucinations, orientation, memory, etc., could not be obtained. Emotionally seemed to be depressed and apathetic. The patient remained in the above condition for a number of months, during which time he was visited by his brother, but would not make any conversation with him and showed utter lack of interest in his visit, but did write the following: "Tell them that I feel different at different times of the day. Sometimes my fingers and muscles are stiff, and headache, and different times my neck gets stiff, crampy like. Tell them that I would like to see them, but it isn't very pleasant when one can't talk to them. Give them my best wishes, that is the best I can do, for I don't feel capable of doing anything rightly, only once in a while for a few moments, or half hour at a time; only my mind moves too fast for my brains, that is as near as I can explain my troubles."

Aug. 14, 1916: Wassermann reaction on blood, positive; on spinal fluid, doubtful: cells, 0; globulin, 3; albumin, 3; gold, 44433321. He continued for the most part mute; would answer questions by "yes" or "no;" would stand for the most part of the day in a particular part of the ward, leaning against the wall.

On Dec. 13, 1916, it was noticed that he had lost the use of right leg. At this time he talked more, and showed fairly good memory and orientation. On December 15 his right arm showed almost complete paralysis. He answered questions quite satisfactorily, and there seemed to be less retardation.

Dec. 19, 1916: The Wassermann test on blood and spinal fluid was positive, the fluid showing albumin, 2+; globulin, 1+; gold, 555555444. At this time he was put on treatment of diarsenol and salicylate mercury, diarsenol being given intravenously and salicylate mercury intramuscularly. The spinal fluid and blood were tested from time to time, the blood alternating between positive and negative. The last test made gave the following blood and spinal fluid negative: cells, 0; gold, positive, but less typical; globulin, 1+; albumin, 2+.

To summarize: this patient showed mutism, lack of interest, untidiness, slow stereotyped movements, apparent dementia, psychomotor retardation, positive serology of paresis, slight tremor, increased reflexes except pupillary, which were sluggish.

At the present time this patient shows remarkable improvement, both mentally and physically. In fact, the improvement has been sufficient to warrant his going away from the hospital on a six months' visit with his brother. He returns to the hospital weekly for his treatments unaccompanied.

While nothing new or remarkable has been advanced by reporting these cases, yet to my mind it shows the importance of doing routine blood examination of both old as well as newly admitted cases, as one of the above reported cases was found by the routine blood examination which would not otherwise have been properly diagnosed, inasmuch as every sign and symptom pointed toward the diagnosis of dementia præcox during the first number of months of its course, and probably would have gone the way of dementia præcox. It goes without saying that the sooner the treatment is started in such cases, before pronounced destructive organic changes occur, the better are the chances of improvement. In light of the foregoing is it not possible that some of our apparently dementia præcox patients who have not had their blood submitted to the Wassermann test may be suffering from some form of neurosyphilis?

AN EPIDEMIC OF DYSENTERY AT THE BOSTON STATE HOSPITAL, DUE TO A MEMBER OF THE PARATYPHOID-ENTERITIDIS GROUP.

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I. Introduction.

The so-called "asylum dysentery" still presents a problem as regards etiology, pathology and prevention. The finding of the Shiga bacillus in connection with numerous outbreaks has led to the assumption that it is always the causative organism. That other organisms may be concerned is demonstrated by the outbreak here reported, which occurred in the infirmary building of the Boston State Hospital in the spring of 1915. The cases were unusual, both clinically and bacteriologically, and therefore it seems of interest to report the epidemic. The severe cases were characterized clinically by acute dysenteric symptoms and the fatal cases by septicemia and bronchopneumonia. The intestinal condition found in the autopsied cases was a wide spread membranous ileocolitis. The cases of moderate severity had blood and mucus in the stools, without much prostration while the mild cases had only diarrhea. The organism isolated in connection with the epidemic is a member of the paratyphoid-enteritidis group. In August, 1915, the disease reappeared in the infirmary, and there was also an outbreak in the other buildings located near the infirmary. Isolated cases occurred in the infirmary during the winter of 1915–16, and in the spring of 1916 small numbers in both the Infirmary and the Cowles building. An effort was made to prevent the occurrence of the disease by prophylactic vaccination. Observations were made on agglutinin formation in the disease and after prophylactic inoculation. Skin tests were carried out with members of the paratyphoid-enteritidis group, and the leukocytic reaction was studied after prophylactic and therapeutic administration of vaccine.

II. Epidemiology.

The infirmary is one of the buildings of the West Group, in which, as is seen by reference to Chart 1, are also the Cowles building for chronically disturbed women, and the Fisher building, containing wards for chronic men patients, officers' quarters, the kitchen supplying the entire West Group, and dining-rooms for the nurses and other employees of the group; and, near the infirmary, the cow and horse barns and the piggery.*

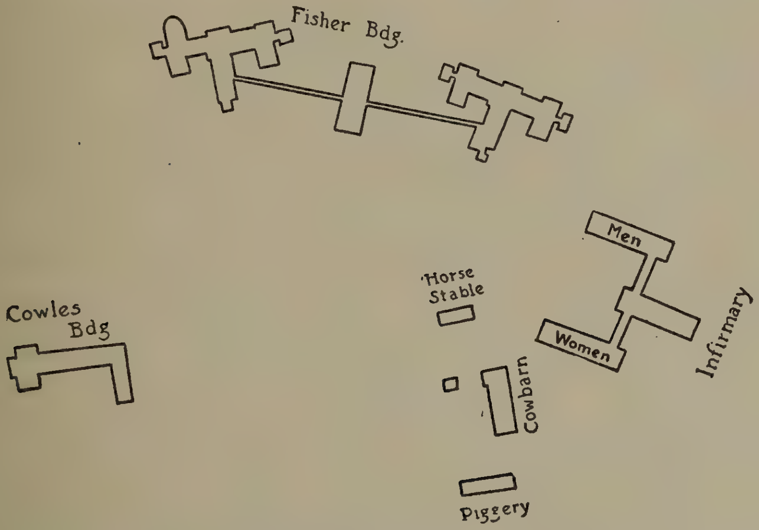

Chart 1.—Buildings of West Group. (Scale of feet: 100 = |——|.)

The first outbreak of the dysentery occurred in the infirmary in April, 1915. In this building are about 380 patients, four wards each for men and women. The class of patients is limited to the elderly infirm and those having a chronic organic disease.

On the women's side the first case appeared April 15 and the last April 30. Eleven patients had the disease in a very severe form, and of these 6 died. One nurse had a short but moderately severe attack, and 3 nurses had diarrhea.

On the men's side the first case developed April 24, the last May 13. There were 8 cases, some quite severe, but none fatal.

The majority of the cases on the women's side came from a ward (V) on which the patients were up and about and some of them very untidy. The other cases, with one exception, appeared on the ward (VIII) to which those having the disease were transferred.

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* During 1916 the piggery was removed to a remote location and cow barns closed.

The first 3 cases occurred within three days' time and varied sufficiently in clinical signs so that they were not immediately classed together. The first appeared as a severe diarrhea in a very untidy senile dement; the second as a dysentery in an untidy paretic; the third patient showed lung signs twenty-four hours preceding the dysentery and died in five days. There was no autopsy. On April 20 the head nurse on Ward VIII, where these patients were isolated, had a diarrhea for one day, beginning twenty-four hours after the transfer of the patients to her ward. On April 25, when 4 more patients on Ward V had a dysentery, 2 nurses had a diarrhea, one of them being a night nurse working between Wards V and IV. On Ward IV a patient was taken ill with dysentery about two days later. As this patient had been cared for especially by the above-mentioned nurse, it is possible that she contracted the disease from the latter. On April 28 the last case on V developed, and on the thirteenth 3 new cases appeared on VIII.

In the earliest cases bacillary dysentery was ruled out by cultures from the stools. The clinical signs were so similar after the disease was once established that there was no doubt of an epidemic. The sequence of cases on the women's side was such that it seemed probable that the disease was being communicated from one person to another; therefore all suspects were at once isolated, and those having the disease were put in single rooms, with strict isolation and careful disinfection. On the suspected Ward V all untidy patients, whether having a diarrhea or not, were put to bed, and their stools inspected and disinfected. No new case developed on the women's side of the infirmary between May 1 and mid-August, the beginning of the second outbreak.

On the men's wards, as on the women's, there was one ward entirely free from the disease. These were both wards on which nearly all the patients were bedridden. On the other wards of the men's side the cases occurred in such sequence that no conclusion could be drawn in regard to the mode of transmission of the disease. A nurse who slept on the women's side, but worked among the men patients, had a diarrhea at the date of the first onset among the men patients, but it could not be satisfactorily proved that she was the carrier. No new case developed on the men's side between mid-May and mid-August.

In the investigation of the source of the epidemic, attention was directed first to the food and milk supplies. The food supplies for the entire West Group are brought over daily from the main storehouse at the East Group, a quarter of a mile distant. The milk comes partly from the hospital herd and partly from a city firm. The food for all persons in the West Group (staff, employees and patients) is prepared in the main kitchen at the Fisher building (see Chart 1) by three cooks, assisted by six patients from that building. The nurses in each ward are assisted in serving the food by several patients living on the ward.

Identification of the organism concerned in the epidemic as a member of the paratyphoid-enteritidis group at once brought the meat under suspicion, in view of the association of bacilli of that type with epidemics of meat poisoning. Cultures were made from the surface and interior of meat and poultry in the West Group refrigerator at the beginning of the epidemic, but the results were negative. Cultures from the milk of both the State Hospital and outside supply were also negative.

Investigation of the West Group kitchen employees and patients, also of the porter and his assistant (patient) who delivered food to the infirmary, elicited no history of diarrhea and they all gave negative agglutination reactions with the epidemic organism. Cases of diarrhea among the patients of the East Group at this time yielded neither the organism nor an agglutination reaction, and at no time since has there been a case of this infection at the East Group. The limitation of the disease to the West Group suggested a contamination of the food after reaching the group. The examination of food and food handlers was made before the two isolated early cases, described in the following paragraph, were discovered.

Finding the agglutination test positive among the nurses who had a diarrhea during the first outbreak brought up the question of possible cases previous to that time. Two such were found: a woman patient who had had a diarrhea for one day only (April 4, 1915), who was not on the ward on which dysentery first developed, and a man patient, who is not recorded as having intestinal symptoms, but who on March 20, 1915, had an indefinite illness characterized by fever and muscular weakness.

A review of death and autopsy reports furnished no clue to earlier cases. There had been no epidemic of any kind at the hospital since a paratyphoid *A* infection in 1910.[1]

The West Group refrigerator was out of use during the first two weeks in April, 1915, while it was undergoing repairs, and during this time the food was kept in makeshift places. The reconstruction of the refrigerator was necessitated because it failed to keep the food cold and was not mouse-proof. For a few weeks before the acute outbreak there had been quite a number of mild diarrheas among the nurses and attendants, also affecting some other persons in the group, but not sufficiently severe to incapacitate them. No attention was paid to these attacks at the time, and only detailed inquiry later elicited a history of them.

A remotely possible complication of the situation is the fact that in the spring of 1914 hog cholera was epidemic among the pigs, and again in August, 1915. Hog cholera is thought to be due to a filterable virus, but associated with the latter are various members of the paratyphoid-enteritidis group. The most frequent of these is B. suipestifer, which was at one time thought to be the cause of the disease. The exact relationship of these organisms to the lesions is still undecided. B. suipestifer is supposedly non-pathogenic for man, but a number of human infections proved to be due to it have been reported. These were of the acute intestinal type. The occurrence of hog cholera the year previous to the human epidemic, the known association of the paratyphoid-enteritidis group with hog cholera, the finding of a member of the group as the cause of the human epidemic, and evidence which tended to show that the latter was not due to a suddenly introduced food infection, raised the question of a possible connection between the animal and the human epidemic. Cultures were made from the lymph nodes and spleen of a hog-cholera animal killed at the hospital in August, 1915. The organism proved to be of the colon bacillus type, and by agglutination reactions did not show a close relationship to the bacillus of the human epidemic.

From a review of the first outbreak it seems probable that the immediate source of the epidemic was not a suddenly introduced food infection; that the disease was communicated from one person to another; that it was endemic, and that previous mild cases of diarrhea among patients and employees had been overlooked. There is a possibility that the cause of these diarrheas may have been contamination of the food in the refrigerator by rats and mice, as these animals frequently harbor bacteria of this group in the intestine (mice, B. suipestifer;

rats, B. enteritidis).[2] It may be possible that these animals were the connecting link between the hog cholera and the human epidemic.

The second outbreak began in mid-July, with mild attacks of diarrhea among the nurses at the Cowles building. These were not mentioned until dysentery appeared among the patients of this building early in August. The Cowles contains about 125 chronically disturbed women, young or in early middle life, and nearly all strong physically. From August 1 to October there were 24 cases, and no ward was exempt.

In mid-August came a recurrence in the infirmary, on both the men's and women's sides, without regard to wards. About the same number of patients had the disease as in the spring, but there was only one fatality. The last group of cases was on the women's side, 1 case on September 30 and 9 between October 23 and 27.

In mid-August and early September there were also a number of cases of diarrhea and dysentery in the Fisher building among patients, nurses and officers.

As to the mode of transmission of the disease in the second outbreak, there seems no doubt but that flies played a leading part, for they were very numerous in all the buildings of the West Group. The buildings are incompletely screened. As breeding-places for flies should be mentioned the stables, barns and piggery, which were situated within a few hundred feet of the buildings for patients.

III. Clinical Description.

The following is a description of the disease as it appeared on the women's service of the infirmary during the first outbreak. The disease as a whole presented such a definite picture that it is unnecessary to describe individual cases. The duration in recovered cases was about three weeks, in fatal cases five to ten days. The incubation period could not be definitely ascertained, but the limits were apparently twenty-four hours and seven days. The onset was characterized by prostration, headache, backache, and large watery stools containing mucus and blood.

The temperature curve was somewhat variable. The initial temperature was between 99° and 104°, but was usually high, remaining so from three to five days, then dropping gradually during one or two days to 99°, and remaining there for about

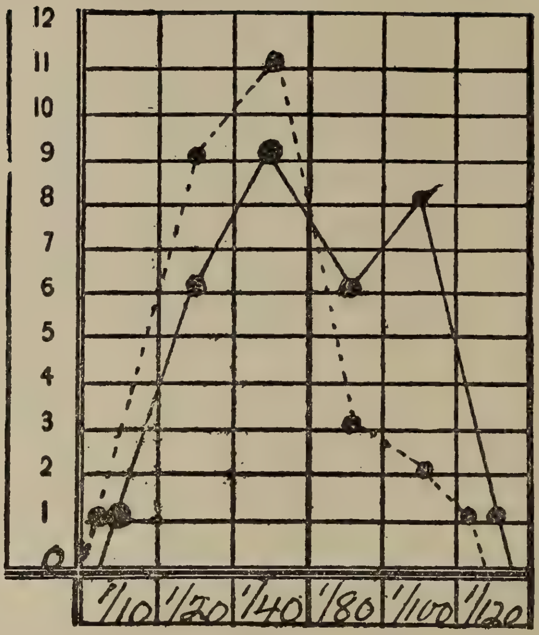

Chart 2.—Agglutination reactions in third and fourth weeks after onset. (———— Dysentery cases 32; .... Diarrhea cases 27.)

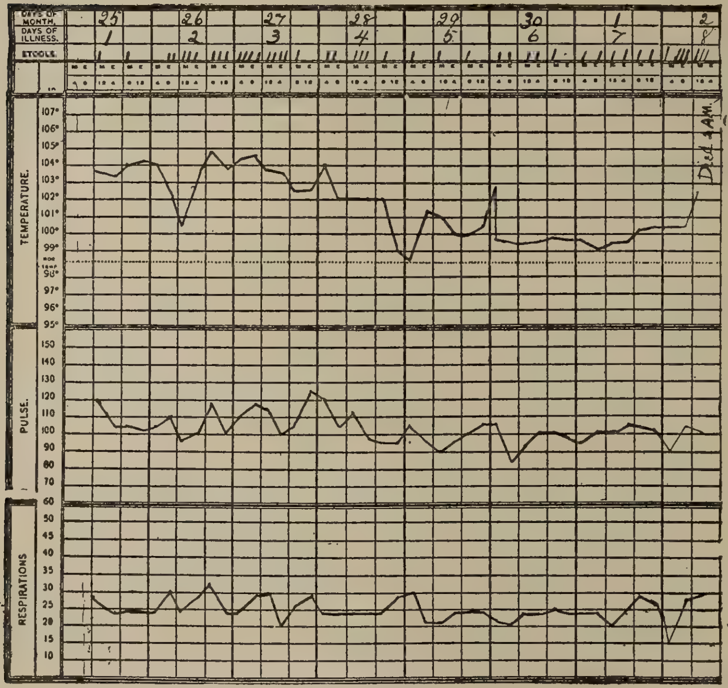

Chart 3.

a week before returning to normal. Occasionally there was a rise to 101° after the fall. The pulse was usually high with the temperature, 110 to 120. One fatal case, however, had an initial pulse of 100 with a temperature of 104°, with a rise in the pulse rate as the temperature fell.

A few hours after the onset the tongue became dry and covered with a white fur and the lips were dry and red. With the fall of temperature the tongue gradually became moist, but the heavy white coat persisted after the dysentery had ceased, even as long as three weeks.

There were no throat symptoms and no glandular enlargement.

The liver and spleen were not enlarged, either at the beginning or as the disease progressed.

Nervous symptoms were not prominent. The headache disappeared within twenty-four hours. Two of the fatal cases became restless, picking at the bedclothes.

The skin showed no rose spots. The face was much flushed during the high temperature, then the face and body became sallow and the skin dry.

The appearance and number of the stools were quite characteristic, six to eight in twenty-four hours, large, watery, brown, containing blood and mucus. The odor was exceedingly foul. In one fatal case, two days before death there was a severe hemorrhage, with large clots of blood. In another fatal case there appeared large pieces of mucus, almost like casts of the intestine. In the severe cases that recovered, the dysentery persisted two to three weeks.

The abdomen was soft and usually not tender. There was some tenesmus for the first few days. In one fatal case the abdomen became distended with gas a few days before death.

There was marked muscular weakness, persisting weeks and even months after recovery from the dysentery. The muscles became very soft and the patients lost weight early.

Clinical Tests. — The urine showed a trace of albumen. The blood picture varied somewhat in different patients and in the same patient during the course of the disease. In no case did an anemia develop. The total white count was rather more variable than the differential, ranging between 5,000 and 10,000, and not decreasing with the progress of the disease. In the severe cases, uncomplicated with pneumonia, the polynuclears were between 54 and 66 per cent during the first two weeks, the lower per cent. for the individual being in the first week. The lymphocytes persisted rather high, between 27 and 40 per cent. Eosinophiles were not found in any case examined during the first week; in the second week they reappeared in .5 to 2 per cent. Transitionals gave a higher per cent. in the first than in the second week. The blood picture of the third week was practically the same as that of the second week, both for protracted cases and convalescents. In the pneumonic-dysenteric cases, the polynuclears were relatively higher, 72 to 77 per cent., but the total count was only moderately increased, 8,000 to 12,000; in the recovered cases of this class the lymphocytes showed a high per cent., 37 to 43 per cent., in the third week. In all cases blood platelets were much increased.

Blood cultures taken in two cases during the first week were negative. A culture from the urine in one very serious case that recovered was negative for the epidemic bacillus, but yielded a streptococcus.

The diagnosis was made from the clinical signs, finding the organism in the stools, and by the agglutination test (see sections on "Bacteriology" and "Agglutination").

Convalescence was slow because of extreme muscular weakness and recurrence of diarrhea with any but the most careful diet.

Sequelæ were not observed, unless the muscular weakness may be regarded as such.

The diet and medical treatment were about the same in each case. Boiled or plain milk and barley water were best taken, and any change from this routine in early convalescence invariably brought back blood or mucus in the stools. At the beginning of the outbreak some days were spent in experimenting with ipecac and morphine and antiseptic or astringent irrigations. The drugs had no effect on the dysentery and the irrigations were irritating. The following treatment was then adopted: a daily high saline irrigation and strychnia sulphur, grams $\frac{1}{60}$ t.i.d. by mouth. Castor oil was used at the onset and for constipation during convalescence.

Vaccine therapy was tried in two protracted cases. The doses were small, beginning with 50,000,000 and increasing 25,000,000 with each dose until four doses had been given, the injection being made every second day. It may have been a coincidence that convalescence began during this treatment.

The mild attacks among the nurses were characterized by a diarrhea lasting about twenty-four hours, with numerous offensive watery movements, accompanied in some instances by griping pains. The diagnosis was made later by agglutination tests.

The clinical description of the second outbreak in the infirmary, from August to October, 1915, corresponds to that of the first, except that the disease was of shorter duration and less severe. The diagnosis of bronchopneumonia was made in two cases about twenty-four hours before the dysentery appeared. Among the patients in the Cowles building the acute stage of dysentery lasted about three days. It was often ushered in with nausea and vomiting, a sharp rise in temperature and increased respiration. The patients were kept in isolation from seven to ten days and recovered with their former physical activity. The cases among the employees were short attacks of diarrhea or dysentery, lasting from one to three days.

An acute arthritis of the knee joint developed in one of the less severe cases ten days after the onset and two or three days after recovery from the intestinal disturbance. The highest temperature during the arthritis was 101°. A week later the other knee became involved, the temperature again rising to 101°. The leukocyte count was 10,000, with polymorphonuclears 71 per cent.

Differential Diagnosis. — The paratyphoid group of infections is usually divided clinically into a gastro-enteric and a typhoid form, to which it appears, from the present observations and those accumulating during the present war, a third form, the dysenteric, should be added. Bainbridge [2] maintains the view that B. gärtneri, B. suipestifer and B. typhi murium, associated with food and especially meat poisoning, cause the gastro-enteric type, while B. paratyphosus *A* and *B*, spread by human carriers, and never found except in connection with human disease, cause the typhoid form. Uhlenhuth and Hübener,[3] on the other hand, consider paratyphoid *A* and *B* also as a cause of acute food poisoning, and state further that the different clinical types may appear in the same epidemic. During the present European war the British have made numerous reports of paratyphoid *A* and *B* infections, describing chiefly the typhoid form, but mentioning also a dysenteric.[4]

The typical gastro-intestinal form comes on suddenly, usually from twelve to forty-eight hours after eating infected food, with headache, chilliness, pain in the abdomen and vomiting, followed by a rise in temperature and pulse, and a diarrhea. The stools are described as exceedingly offensive, and muscular weakness, both during the acute stage and convalescence, is very marked. The acute period lasts from two to five days, and the total duration of the disease is about one week.

The typhoid variety resembles a mild form of true typhoid. Sequelæ are frequent, the most common, perhaps, being an arthritis. Serious local lesions, such as abscess of the lung or osteomyelitis, may follow paratyphoid *B*.

Short descriptions of the dysenteric form have appeared during the war from British and Austrian sources. Bassett-Smith [4] remarks that cases (military) coming home labelled "dysentery" should be regarded as potential paratyphoid, because many of them are found to be that. C. Miller [4] regards the dysenteric as the most severe form of paratyphoid infection seen at the Netley Hospital. The majority, and most of the severe cases, are due to paratyphoid *A*. He describes the patients as emaciated, blue and pulseless, often showing a petechial rash, subcutaneous hemorrhages, and an aphthous stomatitis and pharyngitis. There is constant flux of pink mucus in small quantities, with tenesmus. The mortality is high.

Korczyski [5] describes four cases of paratyphoid dysentery with autopsy. The disease attacked persons who were physically reduced, and toxic features were prominent. He divides the cases into two groups, the enteric, in which the lesions (hemorrhage into mucosa and occasional ulceration) are situated in the small intestine (the stools are feculent, with only traces of blood, and tenesmus is absent); and the dysenteric, in which there is an inflammation of the large intestine, and stools are numerous, small, with much blood and mucus, and there is tenesmus and pain over the descending colon.

The present disease has clinical features of both the typhoid and gastro-enteric varieties, but differs from the usual picture of both. It agrees with the typhoid form in the presence of a septicemia, respiratory symptoms and arthritis as a sequel, but, considered as a whole, does not give at all a typhoid picture. It resembles the gastro-enteric form in that the symptoms, except in the most severe cases, are predominantly intestinal (although in the typical gastro-enteric variety these are usually of the acute diarrheal and not of the dysenteric type), and in the marked muscular weakness. It differs from it, however, in the absence of nervous symptoms and of the features of an acute intoxication. It is conceded, however, that the gastro-enteric form may vary in its course, that it may be of long duration, with irregular fever, diarrhea and bronchitis; also that systemic infection may follow the acute stage.

The disease which the ordinary severe case resembles most clinically is, however, neither of the chief forms of paratyphoid infection, but bacillary (Shiga) dysentery. A comparison of the main features of the two diseases is therefore given.

BACILLARY DYSENTERY (SHIGA).	EPIDEMIC DYSENTERY (BOSTON STATE HOSPITAL).
Onset.	
Acute diarrhea and colic.	Acute diarrhea or dysentery. Nausea and vomiting may be first symptoms.
General Symptoms.	
1. Temperature 101°–102° F. Severe cases, 104°.	1. Temperature 99°–103° F. at onset. Slightly irregular course.
2. Headache, general malaise, and, in severe cases, muscular pains.	2. Headache, backache, aching in limbs at onset. Prostration.
Abdominal Symptoms.	
1. Pain, severe colic.	1. Pain early in disease and not severe.
2. Tenesmus, marked.	2. Tenesmus early in disease and not marked.
3. Tenderness on pressure.	3. Tenderness not usual.
4. Abdomen usually somewhat excavated.	4. Abdomen usually soft and normal in appearance. Excavated in 1 fatal case. Distended in 1 fatal case.
Tongue.	
Moist, somewhat coated in slight attacks. Thick, dirty brown coat in typhoid dysentery.	Moist in mild cases and dry in severe cases. Heavy white coat.
Character of Stools.	
1. Diarrhea at onset not characteristic.	1. Large, brown watery stools. Odor very foul.
2. Mucus, small amount at first. Pure mucus and blood within two to three days.	2. Flecks of mucus and blood may appear at onset or after one to two days. Both usually absent in mild cases.
3. Quantity is small; an ounce or less, and stools are frequent.	3. May continue large and watery or become small in amount. About 8 stools in twenty-four hours in both mild and severe cases.
	4. Constipation in convalescence.
Lung Symptoms.	
None.	Respiration increased in nearly all cases at onset. Bronchopneumonia and multiple abscesses of lungs in fatal cases.

Bacillary Dysentery (Shiga).	Epidemic Dysentery (Boston State Hospital).
Bladder Symptoms.	
Tenesmus.	No bladder symptoms.
Incubation Period.	
Two to four days.	Twenty-four hours to seven days.
Duration and Course.	
Light cases, four to eight days.	Duration of light cases, one to 4 days.
Severe cases, three to six weeks.	Duration of severe or fatal cases, five days to three weeks.
Disease may become chronic.	Recurrences, but chronic cases not observed.
Complications and Sequelæ.	
Parotitis, ascites, peritonitis. Prolapse of rectum frequent.	Acute arthritis, 1 case. Vomiting, 1 case. Prolapse of rectum, 1 case. Muscular weakness, all cases.

IV. Prophylactic Vaccination.

In December, 1915, and January, 1916, prophylactic vaccine treatment was given to 125 women patients in the infirmary. A formalized vaccine was used, prepared from seven strains isolated in the spring and summer of 1915 from the feces of given clinical cases, also from the heart's blood of two autopsied cases. The especially feeble or sick and those who had had the disease were excepted from treatment, and a few other patients refused to be vaccinated. Fifty-one of the stronger and more active patients were given three inoculations, one week apart, the first 500,000,000 and the remaining two 1,000,000,000. A local reaction was usual, but in only a few instances was a constitutional one observed.

Thirty-two patients received two inoculations and 42 only one. The latter patients were among the bedridden, in whom the local reaction was, as a rule, very marked, with redness and swelling of the entire arm. A constitutional reaction, characterized by prostration, also occurred among the majority of this class. The treatment was discontinued among the very feeble patients because of the disturbing effect of the reactions.

From January, 1916, when prophylactic treatment was given, to July, 1916, there were 17 cases of diarrhea among the women patients of the infirmary. The cases were scattered and few in the winter, but appeared in groups on certain wards in the spring. Of these 17 patients, 10 had been vaccinated (8 with three doses and 1 each with one and two doses); 3 had suffered from the disease in 1915, and 4 had had neither the disease nor the inoculations. All attacks, except one, were mild and short. Some of the patients had only a slight rise in temperature, but all were somewhat prostrated. The exception was a fatal case (see case 5, pathological section) of a severe dysentery, in a senile dement who had refused vaccination; but it should be stated that she had not recovered well from a recent pneumonia and was found also at autopsy to have a subdural hemorrhage. Eight of the 17 cases were on Ward V, which was the hotbed of the disease in 1915.

In the Cowles building, also, there occurred in May, 1916, 3 cases of the short dysenteric type in patients who had not previously had the disease.

Although these experiences indicated that neither prophylactic vaccination nor a severe attack gives more than transient immunity, vaccination was continued in July, 1916, all of the Cowles patients and all additional women infirmary patients who were strong enough for the treatment being given three doses.* It was hoped that by vaccinating shortly before flytime, an immunity of sufficient duration might be produced to tide the patients over that season; and that even if the disease could not be entirely eliminated by prophylactic vaccination, at least its type might be reduced from the severe dysenteric to the mild diarrheal.

From July 1 to October 15 there were 6 cases of diarrhea among infirmary patients who had been completely vaccinated, 5 among those incompletely vaccinated, 2 in patients not vaccinated, and 6 recurrences in unvaccinated patients. There was also 1 case of dysentery and several cases of diarrhea among the 125 inoculated Cowles patients.

Tabulation of the results on the women's side of the infirmary gives the following: —

Total patients completely vaccinated from December, 1915, to October, 1916.	64	Cases among these, .	13	All diarrheas.
Incompletely vaccinated, .	72	Cases among these, .	8	All diarrheas.
Not vaccinated, . . .	65	Cases among these, .	7	1 fatal dysentery.
Total women infirmary patients having disease in 1915.	41	Recurrences among these (not vaccinated).	9	1 dysentery (short). Rest diarrhea.

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* The inoculations were made by Mr. John C. Rock of the Harvard Medical School, laboratory interne for the summer of 1916.

The majority of the cases occurring after vaccination and among those not vaccinated are in patients who are feeble yet not strictly bedridden. New bedridden patients do not usually acquire the disease. The recurrences are in patients who at the time of the first attack were feeble and have since become bedridden. They are, in general, much milder than the original attack, and a number were so slight and transient that they would have passed unrecognized if special study were not being given to the subject.

That the new cases and recurrences are due to the epidemic organism is evidenced by the appearance of agglutination reactions in the former and the persistence of reactions at comparatively high dilutions among the latter after attacks.

Agglutinins range usually from $\frac{1}{80}$ to $\frac{1}{150}$ within one month after vaccination and persist at a low level ($\frac{1}{10}$) for at least ten and eleven months (see section on "Agglutination").

It is evident that immunity after this disease is, at least in feeble persons, irregular and probably usually of short duration. In this respect it resembles Shiga dysentery. The duration of immunity after the various forms of paratyphoid infection is not definitely known.

It is clear, also, that as brilliant results cannot be obtained from prophylactic vaccination in this disease as in the case of either typhoid or probably the typhoid form of paratyphoid. The difficulties are two: the first, inherent in the transient character of the immunity; the second, due to the fact that the disease is particularly prone to attack debilitated persons, who as a rule do not stand prophylactic vaccination well. Nevertheless, the writers are convinced that without it cases of the disease would have been more numerous, and, particularly, more severe during the present year, and that it should be continued upon all suitable exposed patients as another way of combating the disease among a class of patients with whom it is difficult to carry out rigorous hygienic measures because of untidiness and lack of co-operation. It is notable that cases after prophylactic vaccination were decidedly fewer at the Cowles building than at the infirmary, this being due, doubtless, to the stronger physical condition of the former patients. The differences found in the leukocytic reactions of strong and weak patients after doses of vaccine (see section on "Leukocytic Reaction") give a further suggestion on this point. It seems probable that prophylactic vaccination among a fairly strong class of individuals is of considerable value, and that results might be much better among the general population or in armies than in insane hospitals.

The writers have been unable to ascertain that until the present war prophylactic inoculation against members of the paratyphoid-enteritidis group has been tried on a large scale, or that it has ever been undertaken under institutional conditions. Vaccination against paratyphoid *A* and *B* is now, of course, being practised extensively in the European and United States armies, in conjunction with antityphoid inoculation, but data on its efficiency will not be available for some time.

Several experiments in vaccination on a large scale against bacillary dysentery have been made, both in European insane hospitals and among the general population. In the former, the results, although not given in detail, are said to have been successful in stopping an epidemic. Shiga[6] in 1898 to 1900 inoculated about 10,000 persons in a district of Japan where epidemic dysentery prevailed most seriously, and diminished the mortality from 20 to 30 per cent. to about zero.

V. SKIN REACTIONS.

Tests for specific skin reactions were tried with a few patients, of whom 12 had had the disease one to twelve months previously; 10 had received prophylactic treatment one to nine months previously; and 7 had had neither the disease nor prophylactic treatment. Tests with paratyphoid *A*, B. suipestifer and B. enteritidis were also made with these same patients. The method was the same as that described by Gay and Force[7] in 1914 for the typhoidin skin reaction, concentrated 5 per cent. glycerine broth cultures being used, with a similarly concentrated glycerine broth solution as a control. The intradermal was preferred to the scratch method as the reaction with the latter was too delicate and transient and often difficult to distinguish from trauma. Different dilutions of the glycerine broth culture were made with normal salt solution (lowest $\frac{1}{2}$, highest $\frac{1}{12}$) with a desire to find what strength would cause a perfectly distinct reaction in the immune and a negative one in the non-immune individual. By the intradermal method a bleb was formed by the injection of .1 cubic centimeter of the dilution, a short needle of a given caliber being used in all cases.

The reaction from the control dilutions was a slight redness of a few millimeters at the point of injection, disappearing in less than twenty-four hours. The reaction from the culture dilutions was an erythema of a diameter, varying with the strength of the dilution, and having, in some cases, a darker red indurated center. The reading was made at the end of twenty-four hours. The indurated area sometimes persisted for a week.

The following observations were made: —

1. The control patients showed reactions that were often difficult or impossible to distinguish from the reaction in those who had the disease.

2. The reaction varied somewhat in intensity in different individuals, but this did not correspond to the time lapsing between the attack or prophylactic treatment and the test, nor was it more marked in those who had had the disease.

3. In 9 cases in which agglutination reactions were made within a few days or three weeks after the skin test, comparisons were made. One patient who had the disease ten months before showed severe local reaction from a low dilution ($\frac{1}{2}$) of the different cultures and a constitutional reaction, with fainting and nausea; three weeks later the agglutination reaction was entirely negative. There were equally marked skin reactions in 2 patients having agglutination reactions of $\frac{1}{10}$ and $\frac{1}{150}$ three weeks later.

4. High dilutions caused a doubtful or negative reaction in certain patients who had had the disease, although causing a distinct reaction in some control cases.

5. Skin tests made with similar broth cultures of other members of the paratyphoid group showed reactions varying slightly in intensity in the different individuals.

6. The concentrated glycerine broth cultures, made up at different times, varied in their results, and apparently deteriorated in a short time, so that any standardization of dilutions was not possible.

These observations would indicate that the intradermal skin reaction with the concentrated glycerine broth cultures has not been of any clinical value in testing the duration of immunity in these cases, or in distinguishing this disease from infections by other members of the paratyphoid group.

Those who have studied the typhoidin skin reaction vary in their conclusions regarding it. Gay[8] considers it of value in indicating the duration of immunity in those having received prophylactic treatment, that revaccination is indicated when the skin reaction is negative. Kolmer and Berge[9] in their study of the typhoidin skin reaction observed that a reaction could be obtained over a longer period in those who had had the disease than in those having had prophylactic treatment only. They found agglutinins and complement-fixing antibodies usually present in those reacting to the skin test. Kolmer and Berge used a powdered typhoidin and control furnished by Gay, but, because of the severe reaction caused by the control, they regarded the reading of the tests as subject to error.

An effort will be made to test these patients with powdered cultures of the same members of the paratyphoid group before setting aside the skin reaction as of no clinical value in this disease.

VI. THE LEUKOCYTIC REACTION.

Gay and Claypole[10] in their experiments in typhoid immunization found that a specific hyperleukocytosis, preceded by a leukopenia, was produced in typhoid immune rabbits by inoculations with typhoid vaccine, and that the important cell in the gain was the polymorphonuclear. The leukocytic response was more rapid and rose to a greater height in the immunized rabbit than in the normal animal. H. I. McWilliams,[11] in a more recent report of similar experiments with rabbits, noted a hyperleukocytosis which was not of a higher grade in the immune than in the non-immune animal.

Both Gay[12] and McWilliams[13] have described the leukocytic reaction following injections of vaccine in typhoid fever. A chill and rise in temperature are coincident with a leukopenia shortly after the inoculation, and a few hours later, with the lowering of the temperature and a lessening of symptoms, there is a high-grade hyperleukocytosis. The relation of the hyperleukocytosis or "leukocytic crisis" to the freeing of antibodies indicates the possible value of these studies in vaccine therapy and prophylactic immunization.

Although our examinations have been limited to human cases and have not the exactness of results obtained in animal experimentation, they have a certain clinical value, because it has been impossible to observe these cases over a number of months.

A polymorphonuclear leukocytosis, both actual and relative, was demonstrated in one protracted case (M. G.) during the first outbreak of dysentery, after a repeated therapeutic dose of the dysenteric vaccine. Six hours after a subcutaneous injection of 75,000,000, the total count rose from 6,400 to 19,400 and the polymorphonuclears from 56 to 76 per cent., with a loss of eosinophiles. No constitutional reaction followed successive small doses in this patient, although there was an apparent improvement in symptoms.

A polymorphonuclear leukocytosis was observed in a second case eighteen hours after an initial prophylactic inoculation of 500,000,000 and six hours after the onset of a severe constitutional reaction, with fever and vomiting. Total count, 18,800; polymorphonuclears, .92; lymphocytes, .08; large mononuclears, transitionals and eosinophiles, 0. This was the only count made in this case. There is no record eleven months later that this patient has had an attack of the disease.

Because of these isolated observations it seemed worth while to study the leukocytic reaction more carefully, and during the seventeen months following the first outbreak several series of examinations were made, including one woman and four men who had neither the disease nor prophylactic treatment, and four women who had had the disease from nine to seventeen months previously. Subcutaneous injections of vaccine were given for two or three successive weeks in doses as in prophylactic treatment, beginning with 500,000,000. In two cases the counts were taken at two-hour intervals during the first twenty-six hours after the inoculation. In all the other cases counts were taken during either the first twelve or the second twelve hours at one-half, one-hour or two-hour intervals.* Differential as well as total counts were made, and a control count was made in each case. There was no constitutional reaction observed in any of these cases and the local reaction was moderate.

The leukocytic reaction consisted of a hyperleukocytosis, with the highest count rising but little above twice that of the normal count for the individual, and a relative increase in polynuclears at one or more periods during the following twenty-four hours, this relative increase not always being synchronous with the highest total count.

The reaction was somewhat more marked after the second or third inoculation than after the first, except in one case, in which the vaccine was injected shortly after a recurrent attack. In this case the reaction was greater after the first injection of 500,000,000, two days after the attack, than after the second inoculation of 1,000,000,000, seven days later. One case (M. G.), referred to above as showing marked reaction to vaccine therapy on the first attack, showed a moderate reaction both in total and differential counts following an inoculation of 500,000,000 nine months later; and on the third day of a recurrent attack, seventeen months later, gave evidence of a reaction only in a relative increase in polymorphonuclears following an injection of 500,000,000. The diarrhea in this last instance ceased a few hours after the inoculation and there was no evident constitutional disturbance.

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* A number of these counts were made by Mr. J. C. Rock of the Harvard Medical School.

There is no record that the individuals chosen as normal cases in this series of examinations have had an attack of dysentery or diarrhea.

In comparing the leukocytic reaction with the clinical history in these cases the following conclusions have been made: —

1. The stronger normal individuals show more reaction to subcutaneous injections of vaccine than the weaker ones who have had the disease and recurrent attacks.
2. The leukocytic reaction for the individual is more marked during or immediately after an attack of the disease and diminishes with recurrent attacks. This corresponds to the clinical observation that the resistance of the individual to the disease is lessened by a previous attack.
3. The fact that there may be a polymorphonuclear reaction to a subcutaneous injection of vaccine, coincident with the cessation of a diarrhea, would indicate the use of vaccine therapy. In the few cases in which this treatment has been given, the results have been favorable for a recovery from an attack.

VII. Bacteriology.

The method of isolation of the organism was that usually employed for bacteria of intestinal infections. A loopful of the fresh stool was put into a broth tube, portions containing blood or mucus, if present, being selected. After two hours' incubation, surface inoculations were made on Congo red lactose agar plates. The organism predominated on the plates during the acute stage, and was frequently present in almost pure culture. It was found as long as blood and mucus persisted and for some days after the stool began to be formed, but was not isolated after the acute stage, in cases either that recovered or that came to autopsy.

On Congo red plates at the end of twenty-four hours the colonies were round, raised, with smooth edges, translucent gray, averaging ½ millimeter in diameter. During the second twenty-four hours they became an opaque gray, and increased to about 1 millimeter in diameter. They did not form acid.

The organism when first isolated appeared as a small, short, thick Gram-negative bacillus. After artificial cultivation longer forms appeared. When first isolated it appeared nonmotile, but after frequent replants it took on a moderate motility. It grew quickly and well on the usual media.

Cultural Characteristics. — Agar: A raised, moist, gray streak with wavy borders. The growth was delicate at first, but after several replants became heavier and whiter.

Broth: a light diffuse cloud with somewhat ropy sediment.

Gelatin: not liquefied.

Litmus milk: the results were variable.

An acidity, usually slight, developed slowly (within two or three days) and in some cultures remained permanent as long as the tubes were observed (four weeks). Other cultures after an initial acidity became somewhat more alkaline at the end of three to four weeks.

Indol: tested in Dunham's peptone solution at the end of four days. One-half the strains gave a negative, the other half a faint positive reaction.

Fermentation Reactions were tested qualitatively in Hiss' serum water, and quantitatively in sugar-free broth containing 1 per cent. of the substances giving an acidity in the former medium. The substances used were dextrose, lactose, saccharose, maltose, dextrin, salicin, glycerin and mannite.

Table I. — *Qualitative Reactions of Epidemic Organism.*

Litmus Milk.	Indol.	Fermentation Reactions (Litmus Serum Water).							
		Dextrose.	Lactose.	Saccharose.	Mannite.	Maltose.	Dextrin.	Salicin.	Glycerin.
Acidity, slowly changing to alkalinity in some strains; permanent acidity in others.	0 or faint +	+ gas	0	0	+ gas	0	0	0	0

TABLE II. — *Acidity in One Per Cent. Sugar-Free Broth.*

CULTURE.	Dextrose.	Lactose.	Saccharose.	Mannite.	Maltose.	Salicin.	Glycerin.
M,	+3.4	−0.8	Alkalinity	+3.4	+0.2	Alkalinity	+1.3
B,	+1.7	−0.4	+1.8	+2.8	+0.1	Alkalinity	+1.9
P,	+4.3	−1.0	Alkalinity	+3.2	+0.3	Alkalinity	+0.8
A-15-24 Heart,	+1.9	−0.2	Alkalinity	+2.4	+1.1	Alkalinity	0.0
L,	+3.4	−0.9	Alkalinity	+3.2	+1.1	Alkalinity	Alkalinity
W,	+2.2	−0.8	Alkalinity	+3.5	0.0	Alkalinity	+0.8
Paratyphoid *A*,	+3.1	0.0	Alkalinity	+3.7	0.0	Alkalinity	+1.2
Paratyphoid *B*,	+2.8	0.0	Alkalinity	+4.0	0.0	Alkalinity	+1.5
B. suipestifer, Ark.,	+2.0	−1.3	Alkalinity	+2.6	+0.3	Alkalinity	Alkalinity
B. suipestifer, Md.,	+1.9	−1.2	Alkalinity	+3.0	+0.5	Alkalinity	Alkalinity
Paracolon No. 17,	+1.5	−0.7	Alkalinity	+2.8	+0.3	Alkalinity	Alkalinity
Paracolon No. 26,	+1.7	−0.6	Alkalinity	+3.0	+0.4	Alkalinity	+1.5
B. enteritidis,	+2.0	0.0	Alkalinity	+3.0	0.0	Alkalinity	+1.0

The qualitative results are given in Table I and the quantitative in Table II. The only substances broken down by all strains are dextrose and mannite, the former usually and the latter always with gas production. Saccharose and glycerin were slightly affected in isolated instances. Salicin, dextrin and maltose were not attacked.

A strain of paratyphoid *A* and *B**, two each of B. suipestifer† and "paracolon bacilli,"* and one of B. enteritidis — Gärtner† — were studied for comparison, and the results are included in the quantitative table.

The colon-typhoid group is divided primarily into a lactose-fermenting (B. coli) and a lactose-negative group. The latter is again subdivided according to the action on mannite; no change, B. dysenteriæ Shiga; acid only, B. typhosus, B. dysenteriæ Flexner; acid and gas, paratyphoid-enteritidis group. The members of this last group are negative to saccharose and salicin and must be distinguished one from another by their agglutinative affinities. The present organism falls in a broad way in the paratyphoid-enteritidis group, as it is a lactose-negative bacillus, forming acid and gas in mannite, and not acting on saccharose and salicin. It differs from the generally accepted characters of the group, however, in a number of particulars. A characteristic of the strains isolated in this epidemic is the variability of their action in milk and in the production of indol. Each strain has retained its original characteristics in these respects after more than a year of artificial cultivation. The paratyphoid-enteritidis group is supposed to form no indol, to ferment maltose with gas formation, and paratyphoid *A* to give a permanent acidity in milk, while the other members of the group give an acidity followed by alkalinity.

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* Obtained from the American Museum of Natural History.

† Obtained from the Harvard Medical School. B. suipestifer Arkansas and Maryland.

Recently, however, Krumwiede, Pratt and Kohn[14] have questioned the value of litmus milk as a medium for differentiating paratyphoid *A* from *B*, as in a series of representations of the group they found that the difference was quantitative only, and that there were numerous intermediate degrees of reaction.

The paratyphoid-enteritidis group is admittedly especially complex and unstable, and the question of the identity or mutual relationships of its members is very confusing and is still unsettled. The cultural and chemico-biological characteristics of various members of the group are essentially the same, so that subdivision according to these is impossible. Agglutination reactions,[15] however, while demonstrating the near relationship of members of the group, do permit a further differentiation into a paratyphoid *B* and a "Gärtner-enteritidis" sub-group. Gärtner antisera do not agglutinate paratyphoid *B* bacilli, and conversely B. antisera do not influence Gärtner bacilli. Complement fixation also shows a separation of the group into the same subgroups. Paratyphoid *A* seems to go in the Gärtner, and B. suipestifer in the *B* subdivision. Paratyphoid *B* is quite uniform in cultural and serological reactions, while the Gärtner group is more irregular in both respects.

In addition, other strains have been described which agree in most cultural characteristics with the group, but are not agglutined by paratyphoid *B* or enteritidis antisera. Immune sera for these strains usually agglutinate only their homologous organisms. These may represent transitions between the two subdivisions. Certain of these cultures have been described under the title of paratyphoid *C*.

As to the normal habitat of members of the group: according to Bainbridge[2] true paratyphoid *A* and *B* are never found except in connection with human disease, while the other members of the group are associated with animals. The normal habitat of

B. suipestifer is the intestine of mice and pigs. B. enteritidis is frequently present in the intestine of healthy rats, and this animal is an important source of the organism. The bacillus also causes an infection of cows and calves. The organism has been the cause of frequent epidemics of meat poisoning, the meat either coming from infected animals, or having been contaminated after slaughter, presumably by rats.

VIII. AGGLUTINATIONS.

A series of agglutination reactions was done, using the sera of recovered and vaccinated patients and of immunized rabbits with the epidemic strains, and also with several representatives of the paratyphoid-enteritidis group which had been studied culturally; also the epidemic strains with rabbit antisera for the same representatives of the group.

The points in view were: the extent of agglutinin formation in the disease, its relation to the type of the disease, persistence of agglutinins after recovery and prophylactic vaccination, and the placing of the epidemic organism in the paratyphoid-enteritidis group.

One or more tests were made on 78 persons. The serum of a normal non-exposed person was used as a control.

The reactions were done by the macroscopic method, using formalized cultures as antigens. For the homologous antigen with patients' sera a mixed antigen was used, made of four strains isolated from the feces, two from the heart's blood and one from the intestinal wall of fatal cases.

All the dysentery cases tested gave a positive reaction in dilutions varying from $\frac{1}{10}$ to $\frac{1}{120}$. Twenty-seven cases of diarrhea occurring in patients and employees at the West Group during the outbreaks of dysentery also agglutinated in dilutions varying from $\frac{1}{20}$ to $\frac{1}{100}$.

Agglutinin formation in the disease, as shown by these results, is very moderate. The highest complete reaction obtained was $\frac{1}{120}$. The majority of the sera obtained to within four weeks after onset agglutinated completely only to $\frac{1}{40}$, smaller numbers to $\frac{1}{80}$ and $\frac{1}{100}$, a few only to $\frac{1}{10}$ and $\frac{1}{20}$ (see Chart 2). As to the relation between the type of the disease and the strength of the agglutination reaction, Chart 2 shows that reaction in high dilutions was more frequent among the dysentery than among the diarrhea cases.

Repeated observations on 12 patients who had a single attack (see Table III.) show that there is a rapid drop in the titre during the first few weeks, in some cases a drop to $\frac{1}{2}$ or $\frac{1}{5}$ between the third and fourth week, and that agglutinins persist (at a low level) in some cases for a considerable time, — as long as seventeen months in one case and fourteen months in two others, although single negative results appear at five to eleven months.

TABLE III. — *Persistence of Agglutinins after a Single Attack of Dysentery.*

CASE.	Time between Onset and Test.	Highest Complete Reaction.
M. Br.,	3 weeks,	1/40
	10 months,	1/20
	14 months,	1/10[1]
Wm. B.,	3 weeks,	1/80
	5 months,	1/20
	17 months,	1/10[1]
M. Cl.,	3 weeks,	1/80
	4 weeks,	1/40
	5 months,	1/20
Wm. Cu.,	3 weeks,	1/100
	4 weeks,	1/20
	5 months,	1/10[2]
C. F. H.,	3 weeks,	1/100
	4 weeks,	1/80
	10 months,	1/10
	14 months,	1/10
M. Ga.,	3 weeks,	1/100
	5 months,	1/40[3]
R. Pr.,	2 months,	1/40
	6 months,	1/20
Th. S.,	2 weeks,	1/100
	3 weeks,	1/80
	2 months,	1/20
	10 months,	1/20
	14 months,	1/20
Geo. H.,	3 months,	1/20
	11 months,	1/10[1]
M. McD.,	2 weeks,	1/100
	3 weeks,	1/40
	13 months,	1/10

[1] Partial. [2] Negative. [3] Therapeutic vaccine treatment.

TABLE III. — *Persistence of Agglutinins after a Single Attack of Dysentery* — Con.

CASE.	Time between Onset and Test.	Highest Complete Reaction.
M. Don.,	2 weeks,	1/40
	6 months,	1/10
	11 months,	1/10
Ger. W.,	2 weeks,	1/40
	8 months,	1/20
	11 months,	1/10[1]

[1] Negative.

After prophylactic vaccination repeated agglutination tests were made on 10 patients at intervals up to ten months. In the majority of cases the titre within a month after inoculation ranged from $\frac{1}{80}$ to $\frac{1}{160}$, but in one case was $\frac{1}{20}$. Values of $\frac{1}{20}$ and $\frac{1}{10}$ were usually obtained at five to six months and $\frac{1}{10}$ at ten and eleven months.

No extended observations on the persistence of agglutinins after paratyphoid infections are available, although, on the strength of tests on single cases, they are said to disappear rapidly. Dreyer[4] has found agglutinins for *B* are always high, while for *A* they are low, after either the disease or vaccination, as compared with *B* or typhoid.

The following antigens were also tried out with a limited number of patients' sera and with rabbit serum for the epidemic strains: paratyphoid *A* and *B*, B. suipestifer Arkansas, B. enteritidis,* and the strain of paratyphoid *A* isolated in the hospital epidemic of 1910.

TABLE IV. — *Sera of Recovered Patients with Different Antigens.*

[± almost complete; ∓ trace.]

PATIENTS' SERA.	Dilutions.	Mixed Strains, Boston State Hospital Epidemic.	Paratyphoid *A*, New Nork.	Paratyphoid *B*, New York.	B. Enteritidis.	B. Suipestifer, Arkansas.	Paratyphoid *A*, Boston State Hospital.
O'B,	1/10	+	+	±	+	+	±
	1/20	+	–	±	+	+	±
	1/40	+	–	±	+	±	±
	1/80	+	–	±	+	±	–
	1/100	±	–	±	+	±	–

* For the sources and cultural characteristics of these strains see Tables III. and IV.

TABLE IV. — *Sera of Recovered Patients with Different Antigens* — Con.

PATIENTS' SERA.	Dilutions.	Mixed Strains, Boston State Hospital Epidemic.	Paratyphoid *A*, New York.	Paratyphoid *B*, New York.	B. Enteritidis.	B. Suipestifer, Arkansas.	Paratyphoid *A*, Boston State Hospital.
W, ...	1/10	+	−	−	+	+	∓
	1/20	+	−	−	+	+	∓
	1/40	+	−	−	+	+	∓
	1/80	±	−	−	+	+	∓
	1/100	±	−	−	+	±	∓
McD, . . .	1/10	+	±	−	+	±	±
	1/20	±	±	−	+	∓	±
	1/40	±	±	−	−	−	±
	1/80	±	±	−	−	−	±
	1/100	±	±	−	−	−	−
M, ...	1/10	+	∓	−	..	±	−
	1/20	+	−	−	..	∓	−
	1/40	+	−	−	..	∓	−
	1/80	±	−	−	..	∓	−
	1/100	−	−	−	..	−	−
O'M, . . .	1/10	+	−	−	..	−	−
	1/20	±	−	−	..	−	−
	1/40	±	−	−	..	−	−
	1/80	±	−	−	..	−	−
	1/100	±	−	−	..	−	−
C, ...	1/10	+	−	±	..	+	∓
	1/20	+	−	±	..	±	∓
	1/40	±	−	−	..	±	∓
	1/80	±	−	−	..	±	∓
	1/100	±	−	−	..	±	∓
S, ...	1/10	+	+	+	..	+	+
	1/20	+	±	+	..	+	±
	1/40	±	±	+	..	+	−
	1/80	±	−	−	..	±	−
	1/100	±	−	−	..	−	−
Normal, . . .	1/10	±	−	∓	+	−	∓
	1/20	−	−	∓	+	−	∓
	1/40	−	−	−	−		−
	1/80				−		−

The results with patients' sera, given in Table IV., show, first, the presence of group reactions; second, the absence of strong reactions with paratyphoid *A* and *B*; third, the non-identity of the present organism with the one isolated in the epidemic of 1910; and fourth, high agglutinations of two sera with B. enteritidis, although these results must be discounted to a certain extent by the reaction of the bacillus with normal serum. With stock paratyphoid *A* and *B* sera the epidemic strains reacted scarcely at all (partially at $\frac{1}{10}$).

A rabbit was immunized with five subcutaneous doses of living broth culture of the same epidemic strains used for the mixed antigen. The antiserum (see Table V.) agglutinated the homologous antigen completely at $\frac{1}{300}$, and almost completely at $\frac{1}{1000}$. It reacted with B. enteritidis better than with the homologous strains, giving a complete reaction at $\frac{1}{1000}$. It agglutinated weakly ($\frac{1}{50}$ complete) paratyphoid *A* and *B* and B. suipestifer, but did not affect the Boston State Hospital strain *A*. These results agree in a general way with those obtained from patients' sera.

A strong anti-enteritidis rabbit serum was prepared, which agglutinated the homologous culture completely at $\frac{1}{1500}$ and almost completely at $\frac{1}{2000}$. Curiously, it reacted only slightly (partially at $\frac{1}{50}$ and $\frac{1}{100}$) with the epidemic cultures. It gave a moderate reaction with paratyphoid *B*, but with *A* reacted almost as well as with its own antigen.

A strong anti-suipestifer serum (complete at $\frac{1}{1500}$) also reacted only weakly with the epidemic strains, but as well with B. enteritidis as with its own antigen; it also agglutinated paratyphoid *B* in high dilutions ($\frac{1}{1000}$), but paratyphoid *A* only moderately.

The results of the agglutination tests with both human and rabbit sera illustrate well the group reactions, but further than that are very difficult, or even impossible, to evaluate, in view of the complexity of agglutination reactions within the group. The outstanding result is that the present organism is not an ordinary *A* or *B*. It does not react to any extent, either, with anti-enteritidis or anti-suipestifer serum, although its immune serum agglutinates both organisms. The high reactions with B. enteritidis should probably be discounted to some extent because of the easy agglutinability of the strain.

As to the place of the present organism within the paratyphoid group, it is impossible to say anything more definite than that

TABLE V. — *Rabbit Antisera with Different Antigens.*

[± almost complete; ∓ trace.]

SERA.	Dilutions.	Mixed, Boston State Hospital Epidemic.	B. Enteritidis.	B. Suipestifer.	Paratyphoid *A*, New York.	Paratyphoid *A*, Boston State Hospital.	Paratyphoid *B*, New York.
Rabbit, mixed strains of Boston State Hospital epidemic.	1/10	+	+	+	+	−	+
	1/50	+	+	+	+	−	+
	1/100	+	+	±	±	−	±
	1/200	+	+	±	−	−	±
	1/300	+	+	±	−	−	∓
	1/400	±	+	±	−	−	∓
	1/500	±	+	±	−	−	∓
	1/1000	±	+	−	−	−	−
Rabbit, B. enteritidis,	1/10	−	+	..	+	..	+
	1/50	±	+	..	+	..	+
	1/100	±	+	..	+	..	+
	1/200	−	+	..	+	..	+
	1/300	−	+	..	+	..	±
	1/400	−	+	..	+	..	±
	1/500	−	±	..	+	..	∓
	1/1000	−	±	..	±	..	∓
	1/1500	−	±	..	±	..	∓
	1/2000	−	±	..	−	..	∓
Rabbit, B. suipestifer,	1/10	±	+	+	−	−	+
	1/50	±	+	+	±	−	+
	1/100	±	+	+	±	−	+
	1/200	−	+	+	±	−	+
	1/300	−	+	+	±	−	+
	1/400	−	+	+	±	−	+
	1/500		+	+	±	−	+
	1/1000		+	+	+	−	+
	1/1500		+	+	±	−	−
	1/2000		−	±	−	−	−
Normal rabbit, . .	1/10	−	−	−	−	−	−
	1/50	−	−	−	−	−	−
	1/100	−	−	−	−	−	−

it is not an ordinary *A*, B. enteritidis or suipestifer, but that, according to agglutinative affinities, it resembles the three latter more than *A*. It does not fit well into either of the chief divisions of the group as outlined by Sobernheim and Seligmann.[15] It might probably be considered as one of the *C* types.

IX. PATHOLOGY.

Autopsies were obtained on two cases in the spring epidemic of 1915, also on a patient who recovered from a severe attack and died five months later of other causes, and two cases of the milder form of the disease which prevailed in 1916.

The two acute virulent cases presented similar pathological pictures. The chief conditions found were: first, an acute fibrinous ileitis and colitis, from which an almost pure culture of the organism was obtained; second, a septicemia, the bacillus being isolated in pure culture from the heart's blood; third, cloudy swelling of the liver, with focal necroses in Case 2; and fourth, a pneumonia of the septic type, with miliary abscesses and large areas of necrosis, from which the organism was recovered, associated with streptococci.

The intestine presented a striking appearance. The lesions began a short distance above the ileocæcal valve, involved the entire colon, and, in the first case, the rectum also. The intestinal wall was thickened and covered with irregular patches of dirty yellow-gray exudate, interspersed with bright-red mucosa, frequently showing foci of hemorrhage. The membrane could be scraped off, leaving an eroded hemorrhagic surface. There were no ulcers and only very moderate swelling of Peyer's patches. The regional lymph nodes were enlarged and injected. Microscopically the intestine showed a necrosis extending inward for varying distances, sometimes converting the entire mucosa into a fibrinous membrane. The latter had sloughed in various small areas, exposing the extremely edematous submucosa. The exudate was composed of lymphoid and plasma cells; polymorphonuclears where fibrin was present, and large phagocytic endothelial cells. The latter were present in some sections in considerable numbers but were not as abundant as in the intestinal lesions of typhoid fever.

The pneumonic exudate was characterized by phagocytic cells, similar to those in the intestine but more numerous. Small numbers were also found in the mesenteric lymph nodes, but none in the liver.

Condensed summaries of the protocols are as follows: —

CASE 1. — R. K. (A-15-23), aged 50. A much demented case of Korsakow's psychosis, in hospital two years. Died on fifth day of dysentery. Autopsy five hours post mortem. Body well built, well nourished. Body heat and rigor mortis present.

Ventral Section. — Small amount of free fluid in pelvic cavity.

Thorax. — Recent adhesions over posterior portions of each lung. No excess of fluid in pleural cavities.

Heart. — Weight, 300 grams. Valves normal. Myocardium somewhat friable and endocardium gray. The descending branches of both coronaries show occasional plaques.

Lungs. — Right: weight, 295 grams. Posterior portion is markedly congested. Remainder of lung is normal. Left: weight, 570 grams. The upper part of the upper lobe is normal. The inferior portion of the upper lobe and the entire lower lobe are enlarged, deep red, firm and nodular. Cut surface is consolidated, reddish purple, and is beset with dull gray foci $\frac{1}{2}$ millimeter in diameter, sometimes depressed in the center. A large amount of thin purulent fluid can be expressed from the tissue.

Bronchi are deep red and covered with purulent fluid.

Abdomen. — Spleen: weight, 105 grams. Firm, purple-red on section. Malpighian bodies just visible.

Liver. — Weight, 1,450 grams. Capsule normal. Cut surface shows a yellow-brown mottling with indistinct lobulation. Consistence soft.

Gall Bladder. — Distended; no stones or adhesions.

Gastro-intestinal Tract. — Stomach, duodenum, jejunum and upper ileum negative. The lower third of the ileum is thickened and edematous. The mucosa is swollen and red, and is irregularly covered with a granular yellow-gray exudate. From cecum to anus the intestinal wall is edematous, and the mucosa is covered with a shaggy membrane which follows the rugæ. On scraping off the membrane a hemorrhagic and eroded surface presents. No ulcers found.

Lymph Nodes in the vicinity of the cecum are enlarged, soft and grayish pink.

Pancreas shows some injection; otherwise negative.

Kidneys. — Combined weight, 290 grams. Capsules are thickened. Cortex measures from .2 to .6 millimeter; is gray, with areas of injection. Pyramids dark red with a white streak at the bases.

Adrenals show central softening; otherwise not remarkable.

Bladder. — Negative.

Uterus. — Pedunculated myoma, 1 centimeter in diameter on posterior surface.

Retroperitoneal Tissues. — Negative.

Organs of the Neck. — Negative.

Head. — Calvarium, thick. Dura not adherent; is moderately thickened along the longitudinal fissure. Sinuses negative. Pia thickened on inferior surface of cerebellum; not elsewhere.

Brain. — Weight *in toto,* 1,350 grams. Marked atrophy of the convolutions of the frontal, central and parietal regions, most prominent in the frontal fields, and decreasing posteriorly. Consistency of the brain is everywhere increased.

Microscopical Examination. — Lungs: section through one of the pneumonic areas. These are situated around fairly large vessels. At the edges of the lesion the capillaries are distended. In the center of the focus the alveoli are filled with cellular exudate mixed with considerable fibrin and serum, and there are small areas of hemorrhage. The exudate consists of polymorphonuclear leukocytes and large phagocytic cells. The latter often reach large size (five or six times the diameter of a red corpuscle), have a coarse-meshed cytoplasm, and contain red corpuscles, pigment and polymorphonuclears. Three or four of these cells are often present in a single alveolus. In several places the alveoli are filled with solid masses of bacteria. The alveolar partitions are frequently dissolved in the center of the consolidated areas. The large veins show very marked inflammation. Sections through the abscesses show extensive foci of necrosis with masses of bacteria and fibrin in the center, surrounded by a zone of degenerated leukocytes. The bronchioles are intensely affected, the epithelium being absent, the walls infiltrated with fragmented leukocytes and the normal structures obscured.

Heart: Perinuclear pigment prominent; otherwise nothing notable.

Liver: The liver cells are indistinct in outline; their cytoplasm stains a dull granular pink, and the nuclei are pyknotic or stain faintly. Fat content is very moderate. Collections of lymphocytes about the bile ducts are frequent, and the sinusoids are dilated. No necroses or phagocytic cells.

Spleen: Lymphoid tissue is small in amount. Pulp contains much blood and collections of golden brown pigment. No phagocytes.

Gastro-intestinal Tract: Stomach, nothing noteworthy. Intestine, sections from various parts of the lower ileum and the colon show the following picture: at the edges of an affected area there is a superficial necrosis with fibrin network. The underlying blood vessels are engorged, the glands choked with desquamated epithelium and débris and the mucosa thickly infiltrated with polymorphonuclears. The submucosa is extremely edematous and is infiltrated with lymphocytes, plasma and large phagocytic cells, similar to those found in the lung. The vascular endothelium is swollen and the vessel walls infiltrated. Large numbers of bacilli are scattered free throughout the mucosa and submucosa. The muscularis contains clumps of large phagocytic cells situated about the vessels. In more advanced areas the necrosis extends deeply into the mucosa, and the submucosa shows areas of hemorrhage and a moderate infiltration of polymorphonuclears. The vessels in the necrotic areas are frequently filled with thrombi of fibrin and leukocytes. In the most advanced portions the entire mucosa is converted into a membrane of necrotic tissue, fibrin, polymorphonuclear leukocytes and masses of bacteria. The membrane has sloughed in numerous areas, exposing the submucosa. The necrosis and sloughing is irregular in distribution and depth. The lymphoid tissue is not hyperplastic.

Mesenteric Lymph Nodes: No hyperplasia of lymphoid tissue. Large endothelial cells, phagocytic for lymphocytes and red corpuscles are very numerous.

Adrenals: The cortical cells stain well in general and are much vacuolated. Small collections of lymphocytes with a few plasma cells in the reticulosa.

The other organs showed nothing of note. The brain and cord revealed no lesions which could be correlated with the acute infection, and the description of them is, therefore, omitted.

Cultures. — Heart's Blood. Epidemic organism in pure culture.

Consolidated Area of Lung: Epidemic organism plus a few colonies of streptococci.

Wall of Cecum: Epidemic organism in abundance on Congo red plates.

Lymph Node near Cecum: No growth for three days, then scattered colonies of staphylococcus albus and streptococci.

Cerebro-spinal Fluid: Sterile.

Anatomical Diagnosis. — Acute membranous ileitis and colitis, septicemia, septic pneumonia with abscess formation, acute fibrinous pleuritis, purulent bronchitis, cloudy swelling of liver, myoma uteri, cerebral atrophy.

Case 2. — E. H., aged 63 (A-15-24), paranoid dementia præcox. Hospital residence, three years. Died on the eighth day of illness. Autopsy twenty-six hours after death. Body of a somewhat obese woman. Some distention of abdomen.

Ventral Section. — Omentum contains much fat and in its lower third is adherent to the peritoneal wall. Spleen is bound down by adhesions. No free fluid in peritoneal cavity. The intestines are injected, especially the ascending, transverse and descending colon. Subserous hemorrhages are visible in the cecum.

Thorax. — A few light adhesions over the posterior portion of the left base; otherwise the pleural cavities are free and contain no excess of fluid. Pericardial sac contains a slight excess of fluid.

Heart. — Weight, 450 grams. Epicardial fat abundant. Slight thickening of the edges of the tricuspid and the bases of the aortic valves. Myocardium flabby. Right coronary shows a few small plaques.

Lungs. — Right: weight, 550 grams; left: weight, 530 grams. Both lungs show scars at apices. Upper lobes not remarkable. The posterior portion of the left lower lobe is enlarged, bluish red and firm. Tissue sinks in water, and, on section, discloses an evenly consolidated red surface with multiple clusters of yellow dots, 3 millimeters in diameter, arranged around the bronchioles. The right lower lobe is consolidated but does not show miliary abscesses.

Peribronchial Lymph Nodes. — Moderately enlarged.

Spleen. — Weight, 70 grams. Trabeculæ faint; pulp bright red. Malpighian bodies small.

Liver. — Weight, 2,000 grams. Is adherent to the diaphragm. Shape and capsule not remarkable. Cut surface is yellowish red, and normal markings are indistinct. Consistence soft.

Gall Bladder. — Distended; otherwise not notable.

Gastro-intestinal Tract. — Esophagus markedly injected. Stomach contains fecal material. The intestine is negative to within 6 centimeters of the ileocecal valve. The mucosa of the remaining portion of the ileum is thickened, injected and granular. From the ileocecal valve to the splenic flexure the wall is thick and stiff and the mucosa shows areas of membrane and erosion, but these are not as extensive as in Case 1. The descending colon is less involved and the rectum is comparatively free. No swelling of the lymphoid tissue.

Kidneys. — Combined weight, 320 grams. Capsules strip easily. Cortex is 6 to 7 millimeters in depth and is gray, with foci of injection. Glomeruli not visible.

Adrenals. — Markedly softened.

Bladder. — Mucosa is granular and injected at the trigone. Urine cloudy.

Uterus. — Cavity contains a small amount of turbid fluid.

Calvarium. — Of moderate thickness with small amount of diploe. Dura is adherent to inner table. Pia is lifted from the brain surface by a large amount of fluid; is of normal thickness.

Brain. — Weight, *in toto*, 1,440 grams. Convolutional pattern is simple. No atrophy. Consistence is uniformly increased over the dome. Structures at base negative. Basal vessels free from sclerosis.

Microscopical Examination. — The microscopic findings in the lungs and intestine were similar in all particulars to Case 1, and need not be detailed. The liver showed foci of necrosis, and there was also a chronic thyroiditis.

Cultures. — The organism was recovered in pure culture from the heart's blood and urine, and, in large numbers, from the wall of the colon. In the lung it was associated with staphylococcus albus and aureus.

Anatomical Diagnosis. — Acute membranous ileitis and colitis, septicemia, septic pneumonia with miliary abscesses, focal necroses of the liver, acute fibrinous pleuritis, cardiac hypertrophy and dilatation, chronic fibrous endocarditis, mitral and aortic, acute cystitis, subpial edema.

CASE 3. — E. McK., aged 76 (A-15-41), showed conditions four months after recovery from a severe attack.

The patient, a senile dement, died of bronchopneumonia, chronic interstitial nephritis and general arteriosclerosis. The intestine, to within a foot of the ileocecal valve, was normal. Throughout the remainder of the bowel were numerous foci of injection in the mucosa, in some places limited to the crests of the folds, in others spread over several centimeters of the mucosa. The mucosa was not thickened, the lymphoid tissue not increased, nor were there signs of healed ulcers. Mesenteric lymph nodes small. The gall bladder contained dark, viscid bile, and the lining was not remarkable.

Microscopically, in the injected areas of the intestine the superficial epithelium was absent, and near the surface of the mucosa were numerous large vacuolated mononuclear cells, occasionally containing the remnants of red corpuscles. The mucosa also showed numerous plasma cells and a few eosinophilic leukocytes. The outer coats of the intestine were normal.

Cultures from the intestinal wall, feces, mesenteric lymph nodes and bile did not yield the epidemic organism.

Cases 4 and 5 show the condition of the intestine a few days after an attack of moderate severity. Both patients had blood and mucus in the stools, and died several days after the height of the attack. In both, also, the dysentery was merely the terminal event in the course of organic conditions fatal in themselves.

Case 4. — (A-16-21) was a bedridden paretic. The mucosa of the lower ileum was slightly thickened and moderately congested. The mucosa of the upper half of the large intestine was uniformly congested but not thickened. In the lower half of the large intestine the wall was moderately thickened and the mucosa dull gray and granular, with patches of congestion but no membrane or loss of substance. The feces in the lower intestine were fluid, gray, slightly frothy, not offensive. Microscopically there was a loss of superficial epithelium and masses of bacteria in the glands, but practically no cellular reaction and no changes below the mucosa.

Case 5. — (A-16-24) was a senile dement who had an advanced chronic myocarditis and an internal hemorrhagic pachymeningitis. The mucosa of the cecum was hemorrhagic, and from there on through the rectum the wall was moderately edematous, showed large areas of congestion, and, in places, also prominent mucous glands. The lesion was most marked in the sigmoid and upper part of the rectum, where the entire mucosa was velvety and dusky. Feces were soft and yellow. Sections showed some slight superficial necrosis, some small localized losses of substance extending into the submucosa, moderate edema of the latter, and considerable swelling of the lymphoid tissue. An occasional phagocytic endothelial cell was found, also moderate numbers of neutrophilic and quite numerous eosinophilic polymorphonuclears.

The organism was isolated in pure culture from the heart's blood of this case.

It is evident from the last two autopsies that in the cases of moderate severity there is nothing striking or characteristic about either the gross or microscopic picture of the intestine, as there is in the virulent cases, but the conditions are such as might be found in any mild inflammation of the bowel.

Pathologically, the acute fatal cases differ obviously from bacillary dysentery in the presence of a septicemia and pneumonia, as well as in the absence of intestinal ulcers. The invasion of the blood stream, particularly, allies the disease with paratyphoid infection. The intestinal lesions, as well as the course of the disease, are more acute and violent than those of bacillary dysentery.

The pathological anatomy of paratyphoid infections is incompletely known, as until recently comparatively few autopsies had been done on either the typhoid or gastro-enteric forms. Since the outbreak of the war autopsy reports have been accumulating. In general, the results are that paratyphoid has more tendency to involve the large bowel than does typhoid; that the lymphoid tissue of the intestine is only moderately affected; that ulcers are frequently absent, and when present are usually scattered and small. The histology of the lesions appears not to have been especially considered. Job and Ballet[16] give the findings in four cases of paratyphoid fever (one *B* and 3 *A*) as intense congestion of the viscera, a moderate degree of inflammation of Peyer's patches without ulceration; swelling, infiltration and congestion of the abdominal lymph glands, and intense inflammation of the spleen, with lymphoid infiltration and hemorrhage.

As to the dysenteric form, Stollkind[4] says that 10 cases with lesions similar to dysentery have been reported. Korczyski[5] found in the enteric form of his cases acute hyperemia of the jejunum and ileum, hemorrhage into the mucosa and occasional small ulcers; in the dysenteric form the same changes, with the addition of an inflammatory process in the large intestine, with thickening of the mucosa and ulcers, which could scarcely be distinguished from Shiga dysentery. He did not find extensive necrosis.

In the gastro-enteric form, the most acute cases may show no microscopic lesion except punctiform hemorrhages through the entire gastro-intestinal tract.[3] In more prolonged cases there may be swelling of the lymphoid tissue, ulceration, and even gangrene of the intestine. The majority of the few reported autopsies on cases dying a week or more after onset have shown hemorrhagic inflammation of the ileum, hyperplasia of the lymphoid tissue, and, frequently, ulcers.

None of these conditions agrees with the virulent form of the present disease, which is an acute extensive membranous inflammation of the lower ileum and the colon without gross ulceration or hyperplasia of the lymphoid tissue, and, combined with septicemia and pneumonia of the septic type, characterized by large areas of necrosis.

The finding of streptococci in the urine of two cases and in the lung of one case, combined with the epidemic organism, suggests that in fatal cases this may be a secondary complication of importance.

As to a possible relation of the disease to hog cholera, we have no crucial evidence, having failed to isolate an identical bacillus from the hog cholera animal. One is struck, however, by certain points of similarity in the pathology of the present disease and that of hog cholera, particularly the simultaneous involvement of the intestines and the lungs. The intestines in hog cholera may present various appearances — from simple catarrh to hemorrhagic or diphtheritic inflammation. The most frequent form of pulmonary involvement is an acute fibrinous necrotic pneumonia. Organisms of the paratyphoid group are most frequently found in the lungs and spleen. Uhlenhuth and Handel[17] bring up the question whether they may not be two diseases included under hog cholera, one, very contagious, caused by an ultra microscopic virus, and a second, slightly contagious, by B. suipestifer.

X. Animal Experimentation.

The pathogenicity of the organism was tested on rabbits weighing from 1,800 to 2,000 grams, by both intravenous and subcutaneous inoculation and by feeding experiments.

One-tenth of a cubic centimeter of a twenty-four hour broth culture of a freshly isolated strain given subcutaneously produced no symptoms at the end of three days. There was no local reaction, and the animal was lively and ate well.

Two-tenths of a cubic centimeter of a twenty-four hour broth culture intravenously killed an animal over night. The most striking lesion at autopsy was an extensive necrosis of the liver. Other changes were cloudy swelling of the myocardium and renal epithelium, and diffuse degenerative changes in the cortical nerve cells. The gastro-intestinal tract was negative.

Another rabbit, which in the beginning of the experimentation was given a massive dose of the organism intravenously (.1 cubic centimeter of a moderately thick suspension of a twenty-four-hour agar culture), died over night, showed the above-mentioned lesions in heart, liver, kidneys, thymus and brain, and, in addition, hemorrhage into the small intestine. The intestinal mucosa was thick, velvety, and deep red. The bacillus was isolated from the blood and bile, but not from the hemorrhagic intestinal contents.

A fourth rabbit was fed 1 cubic centimeter of a twenty-four-hour bouillon culture on carrot once a day for three successive days, after which it was fed sparingly on lettuce and carrots once a day. It remained lively, ate well, had no diarrhea, and its temperature was not abnormally high or irregular. It, however, emaciated rapidly and on the eighth day suddenly died. Autopsy showed an atrophic condition of liver and spleen. The mesenteric lymph nodes were enlarged, soft and of a deep red color. The gastro-intestinal tract was not remarkable macroscopically, and the feces were normal. Microscopically, however, there was found at several points in the small and large intestine a necrosis of the superficial epithelium. The surface in these areas was covered with a thick layer of degenerated cells, mingled with masses of bacteria and scattered polymorphonuclear leukocytes. Numerous plasma cells were present in the underlying mucosa, but the remainder of the intestinal wall was negative. There was hemorrhage in the centers of the enlarged lymph nodes; the lymphoid tissue was active; small numbers of mononuclears, phagocytic for lymphocytes, were present, and a large amount of pigment, both intra-cellular and extra-cellular. The liver showed areas of hemorrhage, but no cloudy swelling or necrosis. The spleen contained numerous endothelial cells, phagocytic for pigment. The other organs were not remarkable. Staphylococcus albus was present in pure culture in the heart's blood and the bile. The urine was sterile.

These results show as far as they go that no condition at all resembling the human disease was produced in rabbits by subcutaneous, intravenous or oral administration of the organism. Ordway[18] produced in rabbits a typhoid-like disease by subcutaneous inoculation of another member of this group, B. suipestifer. The constant and most characteristic lesions were necrosis of the liver. The intestinal lesions, which were less constant and striking, consisted in swelling of Peyer's patches and endothelial proliferation.

SUMMARY.

An acute, very contagious disease, of short incubation period, appearing in three forms: the dysentero-septicemic-pneumonic, the pure dysenteric, and the diarrheal. The conditions found in the virulent fatal cases were a membranous ileocolitis, septicemia and a pneumonia with miliary abscesses and large areas of necrosis. The severer forms of the disease occur in debilitated persons. Immunity is of short duration and recurrences (usually mild) are frequent.

The causative organism is a member of the paratyphoid-enteritidis group, more closely allied, as shown by agglutination tests, with paratyphoid *B*, B. suipestifer and B. enteritidis than with *A*, but not identical with any of them.

The disease was limited to certain buildings of the West Group of the Boston State Hospital. The epidemic was preceded by mild diarrheas among patients and attendants, then broke out in violence in one ward, and was passed from person to person by contact. The source of the infection was not definitely determined. The close affinity of the organism with certain members of the group (suipestifer and enteritidis) which are associated with animals suggests the possibility of such an origin. No evidence was obtained connecting the human epidemic with an outbreak of hog cholera which had prevailed in the piggery at the West Group during the previous summer, but the pathological anatomy of the two diseases presents certain features of similarity. The hypothesis is suggested that the infection was introduced by the contamination of food in the West Group refrigerator by rats, the infection appearing first as mild cases of diarrhea, then as an outbreak on a single ward, due probably to gross contamination of the food by a human carrier, the difference in the severity of the disease depending on the physical condition of the persons attacked, and possibly also on the rapid transfer of the virus. The disease has now become endemic and has assumed a mild form.

Prophylactic inoculation will not suppress the disease among feeble patients, although it may have some influence in mitigating its severity. Among strong persons, however, it appears to be of more value in reducing both the number of cases and the type of the disease. Vaccine treatment during the disease has given good results.

A polymorphonuclear hyperleukocytosis occurs after both the prophylactic and therapeutic administration of vaccine. The leukocytic reaction is more marked in the stronger normal individuals than in the feeble ones who have had the disease and recurrent attacks.

Agglutinin formation in the disease is very moderate. Agglutinins for the organism persist in some cases as long as fourteen and seventeen months after the original attack, when there has been no recurrence. After prophylactic vaccination low titres have been obtained up to eleven months.

Intradermal tests with concentrated glycerin broth cultures of members of the paratyphoid-enteritidis group have given unreliable and conflicting results. Tests with powdered cultures are to be undertaken.

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THE TYPE OF FEEBLE-MINDED WHO CAN BE CARED FOR IN THE COMMUNITY.*

By George L. Wallace,

SUPERINTENDENT, WRENTHAM STATE SCHOOL, MASSACHUSETTS.

There has been a gradual reaction against the old and harsh methods of dealing with all classes of moral and mental defectives and delinquents. The growth of knowledge in the community of the close relationship of mental diseases, mental deficiency, crime and poverty has displaced the early methods of resort to physical punishment and, later, the method of segregation of the individual; and in their place has grown up a broad sympathy and willingness to study the individual whose reactions are not entirely in accord with the best interests of society.

A few years ago the probation system, of which this State can now be justly proud, was unheard of. During this last year Massachusetts has placed on probation more than 28,000 people; that is, has permitted this number of individuals to lead comparatively normal lives in the community at a great financial saving to the State, to say nothing of the saving in self-respect to the individual, the family and the community, for the present and for the future.

In the treatment of the physically sick hospitals are necessary, but the whole treatment is directed toward returning the individual to the community. In the modern treatment of the insane large hospitals are necessary, yet in this State, under the supervision of the various hospitals, many patients are successfully boarded out with families; also there are large numbers of the insane who recover and resume their normal activities. Then, in Massachusetts there are no State orphan asylums, thus again showing the growth of tolerance in the community towards its unfortunates.

If we were to follow the light of the first flash in the pan ignited by our "eugenic" friends (to whom we are greatly indebted for throwing much light upon the whole problem) it could very plausibly be argued that for the betterment of society any one convicted of crime should never have his freedom. Any person who has been adjudged insane should be permanently incarcerated; any person who has been physically seriously ill should not again take his place in society; any child who has been so unfortunate as to lose his parents and thus become a public charge should remain in custody, it being possible in any of these cases that the defective germ plasm of his progenitors, which, perhaps, is the cause of his own misfortune, he himself carries and possibly may transmit to his offspring. But with our growing regard for the individual and belief *in* the individual and his rights, our conscience at once revolts against such extreme measures. When the eugenic light was turned on this problem it would not have been surprising had the social worker in his search for a solution of so many social problems advocated wholesale segregation of unfortunates of all kinds. Instead, he is giving more earnest endeavor to the study of the individual, applying all the tests of modern research in his desire to do what is best for each individual case. It is impossible to study this subject without recognizing that that which is for the best interest of the individual is also for the best interest of the community. Therefore the ground is very safe on which is built a system that has for its first aim the interest of the individual.

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There has never been a time when so many activities have been intelligently directed towards the betterment and improvement of the individual who, for any reason, is not reacting normally in the community. When it was determined how large a factor heredity is in the cause of mental defect it was but natural that the community should turn towards the idea of segregation as a great means for the prevention of mental deficiency. The segregation idea is most important, and there is little danger of it being too strongly emphasized. The need for more institutional provision for the care of the feeble-minded in this State is most apparent. Despite the knowledge, however, of the part that heredity plays in the problem of the feeble-minded, yet so strong is the desire in the heart of every parent, guardian, judge, teacher, minister, physician and social worker that every child shall remain in and be a part of the community, that there have not been presented for admission to the institutions any cases of the higher grade types until all means of their remaining in the community have been exhausted. There are, indeed, hundreds of applications for admission on file at our institutions at the present time that show that the only chance for these boys and girls is in the protection and education that an institution affords, as well as for the protection of the community itself.

With the large number of feeble-minded in this State it cannot be considered a practical solution of the problem, however, to segregate all of them in institutions. In fact, such a course, if it were practical from a financial standpoint, would be neither necessary nor desirable. The institution, important as it is, must be considered but a factor in the solution of this problem.

There are large numbers of the feeble-minded in the community, and there always will be large numbers in the community, even after most liberal provision is made. Therefore it seems that the most practical thing to do is to make still more liberal provision for them and aim at a better understanding of how to safely care for the feeble-minded in the community.

In considering what class of feeble-minded individuals may safely remain in the community it is of more importance to study what communities are safe for the feeble-minded. Most communities have certain conditions that make them unsafe for any unsupervised feeble-minded person. Much more depends on the community than on the individual. All feeble-minded persons depend on others for either their proper or improper social reactions. No feeble-minded person has good judgment or can properly adjust himself to his environment. He is dependent on others to properly order his course for him. The majority of the feeble-minded are not vicious but are simply drifters, easily influenced for good or evil. It is therefore impossible to pick out a feeble-minded person and say that he will do well in a community, for his reactions will depend upon the influence to which he is subjected, and the only safe prediction that can be made for his welfare must be based upon knowledge that he will receive proper supervision.

Without special training the feeble-minded person cannot learn to perform the ordinary duties that the normal child naturally picks up, and for this reason we find in the community large numbers of feeble-minded persons who cannot perform satisfactorily the simplest activities. After he has tried this job and that, only to find that he is a failure, is it any wonder that he becomes a serious social problem? How many normal people could continue to react normally in the community if they were robbed of the great opportunity of industry?

With the spread of knowledge of the feeble-minded problem there has been a great demand for increased provision by the school systems for special classes. These classes are becoming powerful factors in the solution of this problem. The teachers for these classes are selected for superior ability. Their remuneration is greater than that of teachers of the ordinary grades, thus giving permanency to their work, making it possible for a teacher to have the same group of children under observation for a period of years. These classes, all under the general supervision of a trained supervisor, and under medical supervision that is provided, make a most excellent organization for caring for the defective children in the community. They are giving these children the advantage of an education such as is provided in an institution, with the advantage also of receiving home care. They are also extending their activities, in some degree, beyond the school by assisting these boys and girls in securing positions, and in some cases carrying supervision to them in their work. These classes also provide a splendid opportunity for the study of the social reactions of these children in the community, a side of the work that it is impossible for the institution to perform. The supervisor of these classes thus has the opportunity to arrive at a fair conclusion as to what children should have institutional care and what children have fair chances for leading harmless and, possibly, useful lives in the community.

With the extension of this movement for special classes, until every school system of any size has a sufficient number to accommodate all children with mental defect, it would seem that the larger number of children with ordinary mental defect could be safely protected and educated in the community. It is, however, with the advent of mature life that the more difficult problems of dealing with the feeble-minded in the community arise. The adult feeble-minded are more difficult to control than the children, due to the more complex social relations into which they are thrown, but chiefly to the failure of the community to disassociate age and responsibility and make proper provision for the supervision of the irresponsible.

This State has already taken a census of its feeble-minded. Would it not be desirable for the Commission on Mental Diseases to keep a permanent registry of all the feeble-minded in the State and work out a system whereby it can place them all under intelligent, co-ordinating supervision? It would be necessary to have a corps of trained workers selected, preferably from institutional employees and teachers of the special classes, — a group of workers who have lived with, worked with, and who know the feeble-minded. These workers could follow defective children leaving the special classes and give them a kindly oversight and supervision that will largely insure against their becoming harmful agents in the community. The feeble-minded most in need of institutional care could better be determined. The institutions could also perform a larger service by co-ordinating with the community in the way of admitting those most in need of institutional care, and placing out in the community many trained cases, were it possible to place them under the supervision of trained workers, those who know the danger signals of the feeble-minded and who have authority to remand to the institutions.

At the present time we are touching the problem only in spots. We are training and caring for the children in the special classes to a certain age and then turning them out into the community — large numbers to become social problems because they have no longer intelligent supervision. There are already hundreds of social problems of the feeble-minded who need institutional care, but for whom there is no provision. There is no doubt that many of these problems could be prevented if there were room in the institutions where some of the children leaving the special classes could be placed for a time, and thus complement the work of the special classes by tiding these children over, perhaps, an especially critical period in their lives; and while doing this, teaching them a useful occupation and placing them later in the community, still carrying to them the supervision they need.

The activities of the various organizations are based upon the expectation of normal reactions by the individual aided. Therefore too often are their agents applying the same methods with the feeble-minded person that they use so successfully in dealing with the normal person, and, consequently, expecting the same results only to be disappointed time after time with the results obtained. The feeble-minded appear as a foreign body and a check under the wheels of their activities.

If it is necessary to make special provision and select a special group of teachers to supervise and educate the feeble-minded children, it is even more essential to make special provision for the supervision of the feeble-minded adult population in the community.

The feeble-minded problem, although closely associated with the various social problems that the organized societies are dealing with, is still a distinct and separate problem that can be best handled by those who are trained with the feeble-minded.

If the authority of the central commission were increased so as to take under a trained supervision all the feeble-minded in the community, it would have the effect upon the various organizations of liberating a tremendous amount of their energy that is now consumed by the feeble-minded problem.

It would be quite possible to indicate classes of the feeble-minded that we think would safely get along in the community, such as young children, the lower grade cases if provided with physical comfort and care, the male, perhaps, more safely than the female, the girl who is not the possessor of physical beauty, the child who has a good home and others, but this would all be but a guess on individual cases.

In closing I can only say that the number of feeble-minded that can safely be cared for in the community is in direct ratio to the supervision that the community is willing to provide, and I believe this could be most easily effected through the extension of the authority and activities of our Commission on Mental Diseases.

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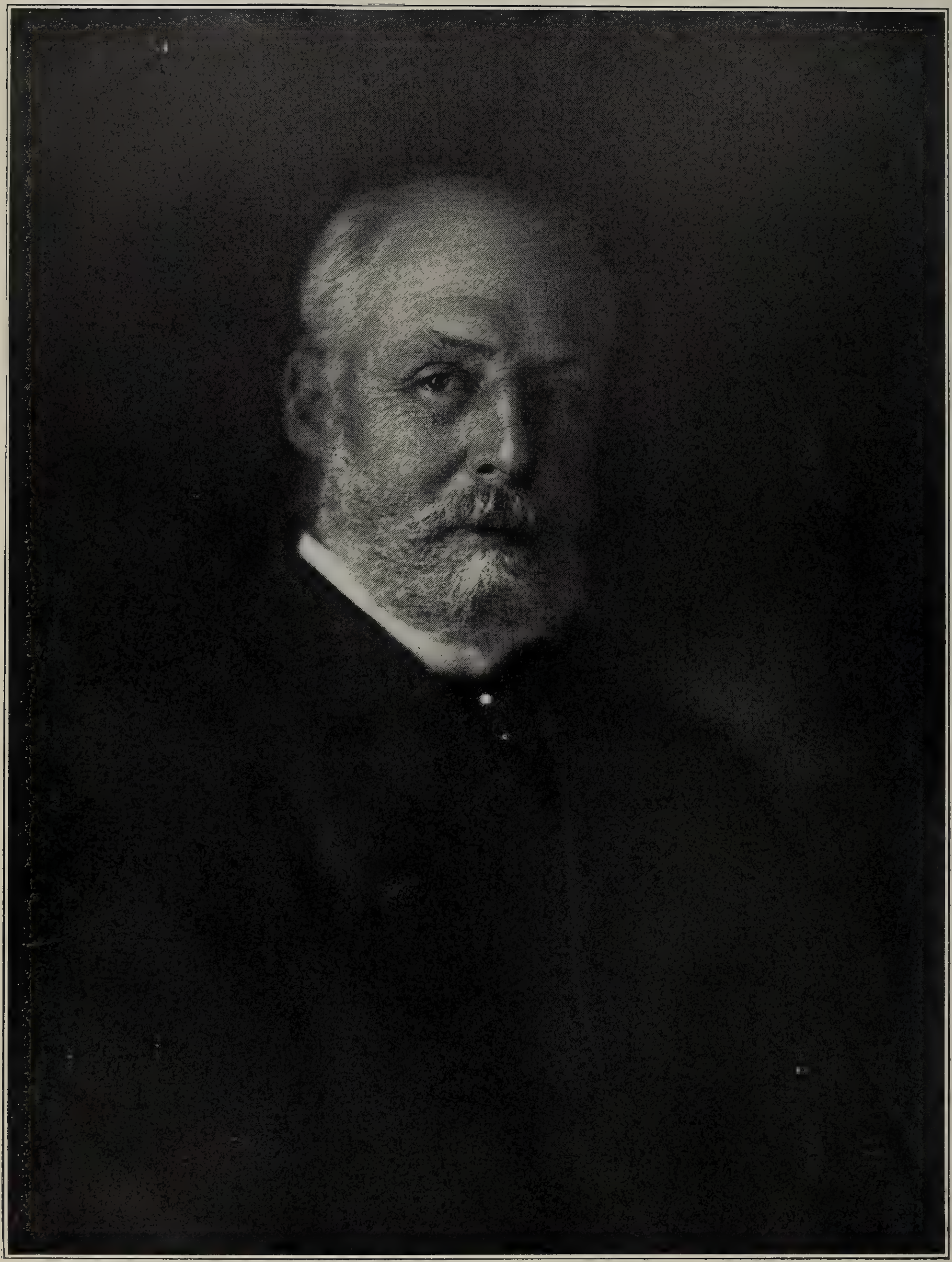

William Norton Bullard, M.D.

First Chairman of Trustees, Monson State Hospital. Served from 1895 to 1914.

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Special Editor

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SELECTED MEDICAL AND SCIENTIFIC STUDIES: MONSON SERIES.[1]

THE FOUNDING OF THE MONSON STATE HOSPITAL.

By Henry R. Stedman, Brookline, Mass.

Dr. Bullard, who was the prime mover in establishing this hospital, could tell this story far better than I, but we all regret that he is unable to be present, and were he here his modesty would probably prevent him from doing full justice to the subject. It therefore has fallen to me to make the attempt because of my close association with him in the work.

The germinal vesicle from which this beneficent organism developed was a paper entitled "Provision for the Care of Adult Pauper Epileptics in Massachusetts," by Dr. W. N. Bullard of Boston, which was read before the Suffolk District Section for Clinical Medicine, Pathology and Hygiene of the Massachusetts Medical Society. In it he showed plainly the crying needs of these unfortunates in the way of supervision, care and treatment at that time, and the total absence of the protection for them and for the public which their disease made absolutely necessary. He pointed out that in the whole range of medical practice in this State there was no class of patients whose interests had been so thoroughly neglected, and he properly criticized the medical profession for its want of energy in drawing public attention in this direction.

When the paper was presented, Dec. 17, 1890, no public institution for the care of epileptics existed in this country. The subject of State provision for this class had been agitated from time to time in Ohio since 1868, and in New York since 1874, but of these facts Dr. Bullard was wholly unaware at the time. A large State hospital for epileptics was ultimately established at Gallipolis, Ohio, in 1892, and the State Colony at Sonyea, N. Y., in 1894. The opening of the Monson State Hospital —

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[1] The following series of 18 publications, whole numbers 207 (1917.27) to 224 (1917.44), comprises a large portion of those presented at the double decennial celebration of the founding of the Monson State Hospital, May 4, 1916.

then designated the Massachusetts Hospital for Epileptics — came next in order in 1898.

I say no hospital in this country antedated these, although of course the Hospital Cottages for Children at Baldwinsville, in this State, was one of the earliest places in which epileptics were cared for, as it had 50 such patients as early as 1886, but it was not designed as a hospital for epileptics. They were accommodated there because there was no other place, and the demand was great for the admission of such cases. This movement for separate State care for epileptics was therefore strictly pioneer work, new not only to this State but to the whole country, and involving the long process of educating the public and enlightening medical men generally before real headway could be made. It is one thing to extend an old system, such as provision for the insane by securing legislation for the erection of another hospital or colony, but it is quite another to prove the necessity and blaze the way for an entirely new public charity involving the annual appropriation of large sums of money from the State treasury for all future time.

At the meeting it was agreed that the question of the establishment of a State institution should be presented to the Massachusetts Medical Society for their endorsement. This was done by Dr. Bullard and its approval obtained. The president of that society also appointed a committee, consisting of Dr. Bullard, Dr. G. F. Jelly, Dr. E. P. Elliott, Dr. L. W. Baker and myself, with full power to prepare a suitable bill and to have the same presented to the Legislature of the State, said committee to have the arrangement and direction of such other matters in connection with the subject as might seem to them to be desirable.

The next step was a petition to Governor Russell by this committee, in which were set forth the situation and needs of the epileptic poor in the community and the total absence of any provision whatever for the non-insane adult of this class. A strong protest was also made in the name of common sense and humanity against the confinement of epileptics in almshouses. The overcrowding of our hospitals for the insane was instanced, and the relief to follow from the removal of the 235 epileptics so inadequately cared for to a special hospital pointed out. The dangers to themselves and others in the path of the epileptic, their ostracism from others in school, in sport, and in occupation, the burden they were upon their families, etc., were

Henry Rust Stedman, M.D.

Member of Committee who petitioned Governor for Hospital for Epileptics.

made plain. The great number of epileptics at large in the community was shown, and the experience of other countries in which separate care was practiced was cited as presenting abundant proof of the entire expediency and great value of such a provision. The great colony at Bielefeld in Germany and its work was briefly described as an object lesson of what might be accomplished.

After referring the petition to the Board of Health, Lunacy and Charity for their opinion and obtaining their hearty approval, the Governor submitted it to the Legislature, recommending early and favorable action, and with the suggestion that the hospital, if established, should be in the form of cottage hospitals. This Legislature referred the bill to the next General Court. The matter came again before the Legislature in 1893, when the Board of Lunacy and Charity repeated its recommendation, and in 1894 another appeal was made, but with no resulting legislation. During these years the matter was kept before the public and physicians through medical articles and reports of legislative hearings until people had become educated on the subject and alive to the needs of the epileptic. Circular letters were sent to physicians all over the State asking information as to the number of epileptics treated by each of them in the last year and in the last five years, and requesting their opinion of the proposed measure. Particulars were also obtained from dispensaries, out-patient departments, almshouses, hospitals for the insane, and general hospitals.

In 1895 we succeeded in enlisting the valuable support of Dr. Edwin B. Harvey, a member of the Legislature, who took an active interest in furthering the bill. He advocated the measure without ceasing among his fellow legislators, and on one occasion with a legislative committee, I remember, visited with us the premises of the primary school at Monson, then abandoned by the State, — a site for the new hospital, which was advocated because of its natural beauty and its advantages for institution purposes, and where this hospital with its forty buildings now stands. Finally, by dint of determination, persistency, diplomacy and his influence as chairman of the committee on public institutions, the act was passed in that year. It provided that all the lands, buildings and personal property then belonging to the State Primary School be assigned to the use of the Massachusetts Hospital for Epileptics, and in addition the sum of $160,000 be appropriated for the construction of such new buildings and for making such repairs, alterations and additions to the old ones as should be sufficient to accommodate 200 epileptics and the necessary officers and employees.

The act establishing the hospital stands to-day as it was originally drafted with but few changes, and none that were not anticipated. Although it was designed to meet the needs of adult epileptics, who were the principal sufferers, we had always in mind the time when gradually restrictions as to age and mental condition should be removed and there should be no obstacle to the admission of any epileptic who was not an inebriate or a criminal. We felt, however, that if the bars were let down at the start to all comers the difficulties of setting the institution on its feet would be greatly increased. I doubt, however, if our unbridled enthusiasm, as some then thought it, ever carried us so far as to predict that the hospital even in eighteen years would be caring for 1,020 inmates, of whom 200 would be children, and that of this number 97 would be under school instruction.

It only remained for the Governor to appoint a board of trustees. This was headed by Dr. Bullard, who acted as its chairman for eighteen years. The other members were Dr. Getchell of Worcester, Dr. Benner of Lowell, Mr. Clough of Boston, Mr. Hyde of Ware, Mrs. Calkins of Springfield and Mrs. Stedman of Brookline. How well these and subsequent trustees played their parts, how the institution waxed strong in its greatly beneficent work and in public confidence and medical repute under superintendents both able, eminently humane and singularly well adapted for administering it, must be told by others.

Much of what I have here sketched is but the story of most efforts, whether successful or not, which are made to secure the passage of important measures, but there are special reasons why the work of establishing this hospital should not be allowed to pass unnoticed. When we reflect that in other directions even minor contributions to the advancement of medical progress directly or indirectly relating to the care, treatment and relief of human suffering of all kinds are properly made matters of immediate record in order not only to establish priority but that others may benefit by methods employed or results obtained, surely such an accomplishment as this of Dr. Bullard's resulting in the relief of many hundreds of sufferers in the past, the present and the future deserves public recognition. Moreover, as an inspiration to others both within and without our institutions the lesson should be of value. Particularly is this needed in the direction of psychiatry in which the medical profession has lagged too far behind in public work resulting in the amelioration of the condition of the insane, and has left to lay efforts reforms of vital moment. I have only to instance the monumental achievement of Dorothea Dix in establishing twenty-six institutions for the insane in this country and initiating reform in the care of the insane in England and Scotland, as well as the recent labors of Mr. Beers of New York in initiating the mental hygiene movement in this country, which has assumed the proportions of a large, well-endowed and practical charity and has already achieved results which promise to be of far-reaching value to the insane of the country.

NOTES ON RESEARCHES IN EPILEPSY AT MONSON STATE HOSPITAL, MASSACHUSETTS.

By E. E. Southard,

PATHOLOGIST, COMMISSION ON MENTAL DISEASES, AND DIRECTOR, PSYCHOPATHIC HOSPITAL, BOSTON, MASS.

Work in epilepsy and especially work in epilepsy at the Monson State Hospital always strikes for me a personal and intimate note because of the relations of my friend and adviser, Dr. William Norton Bullard, there. As you all know, my Harvard professorship in neuropathology is the Bullard professorship, founded chiefly through the interest of Dr. Bullard by members of his family for the purpose of stimulating research and instruction in the fundamentals of diseases of the nervous system. Now research in neuropathology is not a purely university matter. It will never be possible to provide a proper scope for such researches on the academic platform provided by medical schools. Progress in neuropathology is indissolubly united with the progress of institutions and the provision in State institutions of high clinical and laboratory standards. Dr. Bullard, from his initial interest in the epilepsy problem and his long years of chairmanship of the Monson State Hospital Board here in Massachusetts, came to a full sense of the necessity of providing not merely the scientific atmosphere of neuropathological research in medical schools, but also the State basis for such research in the shape of clinical and anatomical material. Among neurological practitioners, Dr. Bullard was for years perhaps the only man in Massachusetts who took a vivid and personal interest in epilepsy and feeble-mindedness. He was one of the very few men among the clinicians outside institutions who could be counted on to further the interests of the State institutions in every way, both from the standpoint of increasing their budgetary support by the Legislature, from the standpoint of improving clinical standards, and from the standpoint of swelling the bulk of scientifically accessible material. Those of you who now contemplate the rather satisfactory provision by the Commonwealth of institutional laboratories for anatomical, psychological and other special studies can have little idea how difficult the erection of these laboratories and these standards has been, and how rarified a scientific atmosphere the laboratory men and the scientific clinicians have had to breathe in an exceedingly recent past.

Dr. Bullard is not present with us to-day and I can therefore speak the more freely of his really unique attitude of scientific interest on the part of an eminently practical neurologist in the clinical work of the State institutions and in the research basis for improved individual work. Dr. Stedman, Dr. Copp, Dr. Page and Dr. Flood, and especially the latter, can all bear witness to Dr. Bullard's indispensable and essential part in the developments we here meet to congratulate ourselves upon. Others here, and especially Dr. Stedman, are to speak upon the history of this institution. For my part I am to say something about the research side. Of course no one who does not live and die in epilepsy work, who does not breathe the spirit of the work daily and see in it if not the only then the most important field in the whole of neurology, is hardly entitled to speak the most effective words. I must confess that when I first looked at the problem from the research side, it was more from a feeling that I should take an interest in what Dr. Bullard had made a principal feature of his work than from any vision as to the research values of epilepsy. I soon came to find that an epileptologist had really to be competent in a wide field of neurology; that he had to be a competent psychiatrist and master of the field of feeble-mindedness, a master of localizing neurology, a competent mental hygienist and diagnostician of general diseases, a man ready to meet all manner of the most perplexing institutional problems. In short, epileptology is a concentrated essence of the entire field of mental hygiene and of neuropathology taken in a very broad sense. As a practical director of an institution for mentally diseased and defectives, I can say that, *ceteris paribus*, I would rather take a man who had had experience with epileptics than a man with institutional experience of any other sort within the range of mental hygiene, if I wanted a man able to jump into the most complex problems and do rough-and-ready justice to them. And I should go so far as to think that if we attempt to solve the problem of scientific teaching of psychiatrists and mental hygienists in the future, no course of post-graduate study for such men would be complete without a considerable contact with the epilepsy problem. If you can handle the problems of the epileptic, it seems to me beyond question you can soon learn to handle the problems of the feeble-minded, of the institutional insane and of much of the practical field of neurology.

But if the practical epileptologist is so much a jack-at-all-trades, then the man attempting the research field in epilepsy must feel his problems all out-of-doors. Can any one doubt that the prime work of Hughlings Jackson and the penetrative systematic work of Sir William Gowers in the field of neurology at large would ever have been so opulent in suggestion had not epilepsy been the nucleus of their interest in neurology? A great deal of effect was also wrought in the work of Theodor Meynert by his thought on the epilepsy problem. The vaguer but still vast implications of the work of Lombroso suggest again how fundamental the concept of epilepsy is in all fields having any alliance with neurology. The largest vistas in psychiatry and neurology are undoubtedly those of epilepsy.

With indications so many fingered and with roads often ending in a *cul de sac,* a maze or a wilderness, what can and should be done in so modest a center of the world's work as an institution for epileptics? With the best interest in the world on the part of the trustees and their worthy chairman, Dr. Bullard, and on the part of the superintendent, Dr. Everett Flood, and his assistants, and with every design on the part of the State Board of Insanity to aid and abet the work, what after all could be done? We must remember that in those early days the Commonwealth of Massachusetts was far less ready than to-day to back research by adding a cent or two to per capita cost of its charges. One of the most eminent men of science our country has produced once sadly remarked to me that in his experience, dating back to the eighties, research had after all to be done chiefly by stealth. Universities and institutes exist with the primary design of extending the scope of instruction and propaganda through the acquisition of new facts and interpretations in the field of research, but owing to the medicolegal nature of the patients in our State institutions, neither universities nor institutes can control the research material in a field like that of epilepsy, feeble-mindedness, insanity or even in such a field as that of crime. The "mountain" of the university has got to be carried to the "Mahomet" of the State institution if we are to get the research faith propagated by the only means at hand, namely, the successful prosecution of researches to concrete results. To employ another oriental figure of speech, we are required for the first few years to make the "bricks" of research without the "straw" of appropriations to that end.

How shall we extract research novelty from routine material is the question that faces those who run State institutions.

I shall now speak somewhat reminiscently of the research work of Monson State Hospital and particularly of the laboratory work. One of the first contacts which I personally had with Monson work was with Dr. Morgan B. Hodskins, who worked with me while I was pathologist to the Danvers State Hospital on a case of the so-called "soft brains." Our note on "Cell Findings in Soft Brains" was published in the American Journal of Insanity in 1907. That problem in itself had little apparent relation to epilepsy, although the particular case examined was one of epilepsy. The brain was universally soft except for the arm areas and a portion of the face and leg areas of the precentral and postcentral gyri. In fact the characteristic focal sclerosis of many cases of epilepsy was here brought out in relief on account of the general encephalomalacia of the brain. This condition of general encephalomalacia, or for brevity "soft brain," might have been regarded as a general histolysis in which all constituent tissues and cells were somewhat equally affected, yet Dr. Hodskins and I were able to prove histologically that the apparent general histolysis was really differential inasmuch as the intact nerve cells of the sclerotic (epileptogenous) areas were just as much affected by acute cell disease (axonal reaction) as the other large cells of the brain.

As I say, this problem, chosen because of its appearance in an epileptic, proved to have little or no relation to the problems of epilepsy as such. In fact the results of this research led far afield into the work done by Prof. F. P. Gay and myself, and later by Dr. M. M. Canavan, upon bacteria cultivated from the cerebrospinal fluid. I need not dwell upon this latter work. Dr. Gay and I in our paper "On the Significance of Bacteria cultivated from the Cadaver," published in the Centralblatt for Bakteriologie in 1910, thought we had suggestive evidence that general encephalomalacia ("soft brain") was due to Bacillus coli communis, whether coming ante-mortem or post-mortem we were hardly able to determine. In later work with Canavan, this hypothesis had to be modified. In the first place, the Boston State Hospital cases showed few instances of Bacillus coli infection or invasion and there were fewer instances of "soft brain" in the Boston series. The instances which Canavan and I found of "soft brain" in the Boston series, although not due to Bacillus coli, might possibly have been due to certain other organisms which we found in association with the cases, all of which organisms were readily able to split culture media. These considerations will show how far afield from epilepsy one is led who tries to solve a single problem, for example, the problem of the nature of the death in a certain case of exhaustion in an epileptic.

At about the same time, I published the analysis of a case of "Focal Cerebellar Lesion in Epilepsy" (Transactions of the National Association for the Study of Epilepsy for 1906). Here attention was attracted to what is doubtless the most striking feature in most cases of epilepsy, namely, focal lesions. W. L. Worcester, pathologist to Danvers State Hospital, had written a well-known paper on "Sclerosis of the Cornu Ammonis in Epilepsy," testing the original hypothesis of Meynert of 1868. Focal lesions of other distribution were well known. I concluded that as many cases of focal lesion as possible should be collected and analyzed. The particular case of cerebellar focus showed a lesion in active and progressive distribution, — the only lesion of the sort in the entire nervous system. Could this lesion be regarded as epileptogenic? The case was one of some fifteen years' standing, and the cerebellar lesion is of very doubtful relation to the epilepsy. Nevertheless there were found in the tissues of this case numerous miliary disseminated small areas of sclerosis. This sclerosis might even be described as submiliary. Seeing that in view of the fact that they might appear in scattered small points in the walls of the perivascular sheaths as well as in the pia mater, I gathered together virtually all of the cases of focal lesions in organic or late epilepsy which the hospital series afforded and published an elaborate paper "On the Mechanism of Gliosis in Epilepsy." Here again is evident the far reach to which one goes from epilepsy as a research basis. In one of the cases was embodied a beautiful observation by Dr. A. M. Barrett "On Acute Encephalitic Focus in the Cornu Ammonis," the only such focus in the brain. This case published by me in the paper "On the Mechanism of Gliosis in Epilepsy" attracted considerable attention as being one of the few anatomically proved cases of the alliance between encephalitis and epilepsy. This line of research has been followed by Prof. W. P. Lucas and myself in various papers on the relation of encephalitis to epilepsy in "Contributions to the Neurology of the Child," published in 1912 and 1913. This work, chiefly the result of some intensive investigation of the Children's Hospital records by Lucas, revealed the fact that there were certain cases of febrile nervous diseases in children that could not be proved to be tuberculous, epidemic, or pyogenic forms of meningitis, and which were sometimes called "toxic" and sometimes received no other diagnosis than "cerebral," but were actually rather to be regarded as cases of the poliomyelitic group. The further study of these cases as they lived in the community after recovery shows a certain tendency to the production of feeble-mindedness and of epilepsy. One instance went directly into the Cottages for Children, whereby we were thereby able to show a relation between epilepsy and encephalitis, long suspected by many workers, yet the tables of contents and the indexes of many of the larger and more important works on epilepsy failed to take into account altogether the possibility of encephalitis as a cause of epilepsy. It is exceedingly important to acknowledge the possibility of acquired epilepsy either through the effects of some poliomyelitic form of disease or through some other acquired cause, since the otherwise excellent work of the hereditarians sometimes gives rise to the belief that the entire problem is a hereditary one, to be met by eugenic measures and not at all open to the methods of preventive medicine. I do not here mean to overestimate the numerical importance of the infectious origin of certain epilepsies. However, the group is an important one and its study should reveal to us a good deal about the intimate nature of epilepsy. Some of the cases of brain lesions, recently described by Dr. Annie E. Taft, give us the ultimate effects in the brain of cases which were doubtless extreme and severe instances of cortical hemorrhage.

Dr. A. E. Taft was the first full-time pathologist at the Monson State Hospital, working there from Jan. 1, 1909, to Aug. 1, 1910. Some of her brain work at Monson has only recently been published, so long does it take the neuropathologist to execute completely all of his anatomical processes. Dr. Taft's work on "Hemiatrophy of the Brain," working chiefly with Monson cases, has thrown a great deal of light upon the nature of the corpus callosum and upon the suspension of growth processes following early injury to the brain. When Dr. Taft and I were busy with the early photographic work, carried on under the scientific investigation fund of the State Board of Insanity, we were greatly struck with the relative simplicity of construction of the brains of the epileptics. It seemed to us then that if a side of a wall were papered, so to speak, with photographs of epileptic brains and the side of another near-by wall were similarly papered with the photographs of brains of the insane, the epileptic wallpaper so produced would be strikingly simpler in design than the insane wall paper. It was on this account that elaborate studies were pursued by Dr. Taft in the counting of the sulci within given areas of the cortex, studies which have been of some anthropological interest and are still going forward.

We can see from this work how extensive an excursion is often made from the nucleus problem to the periphery of research. You can hardly strike in anywhere in the problem of epilepsy without laying hold of a thread which carries you to some exceedingly profound problem. This is another and perfectly sound reason why those who deal with epileptology are apt to have the widest sympathies with all manner of concerns in and out of the field of neurology.

Dr. Taft also made some studies in connection with Brown-Sequard's epilepsy in the guinea pig, devoting herself especially to the hereditary side. It was reserved for her successor, Dr. Leland B. Alford, to make a singular point in connection with Brown-Sequard's epilepsy. The problem of Brown-Sequard's epilepsy is not at all a humdrum problem, but the idea of the inheritance of a type of epilepsy, put forward by Brown-Sequard, has been mentioned in practically every textbook on heredity. The most recent of these books regard Brown-Sequard's epilepsy as a stumbling-block to clear exposition of the biological law of the non-inheritance of acquired characters.

In point of fact, according to Alford, the epileptic attacks which supervene in certain guinea pigs are probably related to the accumulation of lice in the heads of the guinea pigs, which lice cannot be removed by scratching since the guinea pigs have been paralyzed by the trauma to the nervous system, or are unable to scratch by reason of the absence of toes. Brown-Sequard noted carefully the matter of toe amputation, and of course his major contention concerning the appearance of epilepsy on irritation of the trigeminal area of the guinea pigs' heads, following trauma to the nervous system (or of sciatic nerve or otherwise) *on the same side as the injury,* was confirmed.

As far as the hereditary data go, it is not quite clear whether all of the epileptic offspring were guinea pigs with amputated toes or not, though I believe there is some indication that this was the case. At all events in Alford's repetition of this work, the fits were found to follow irritation of the trigeminal areas of guinea pigs when these guinea pigs were paralyzed or unable, through lack of toes, effectively to scratch the lice away. If the guinea pigs were kept free of lice by disinfectants the epilepsy failed to appear. This was the only work done on the Brown-Sequard epilepsy problem.

A great deal of work has since been done by a pupil of Sherrington's, Graham Brown, "On the Physiological Analysis of the Scratch Reflex in this Induced Disease." Much good physiological work could undoubtedly be done in our institutions could the proper experimenter be found.

In the various interregna between pathologists Dr. Hodskins kept up his interest in the autopsy work, and a good collection of brains and a good series of autopsy protocols is available for study. Dr. Alford was succeeded by Dr. Douglas A. Thom, who worked as pathologist at the hospital from 1912–16. Dr. Thom busied himself with the consolidation of the autopsy and protocol series, with statistical work on the relation of epilepsy in the offspring (there seem to be far fewer epileptic offspring of epileptics than prevalent hypotheses would demand), and with matters in relation to epileptic dementia and the like, which will appear in the program of the present meeting. During his régime the photographic work of the institution has been developed thoroughly, and many excellent photographs of special brain lesions have been produced. At the same time, the photographic side of the work of the State Board of Insanity has also persisted, and material for a monograph upon epilepsy, extensively illustrated by brain photographs, has been collected.

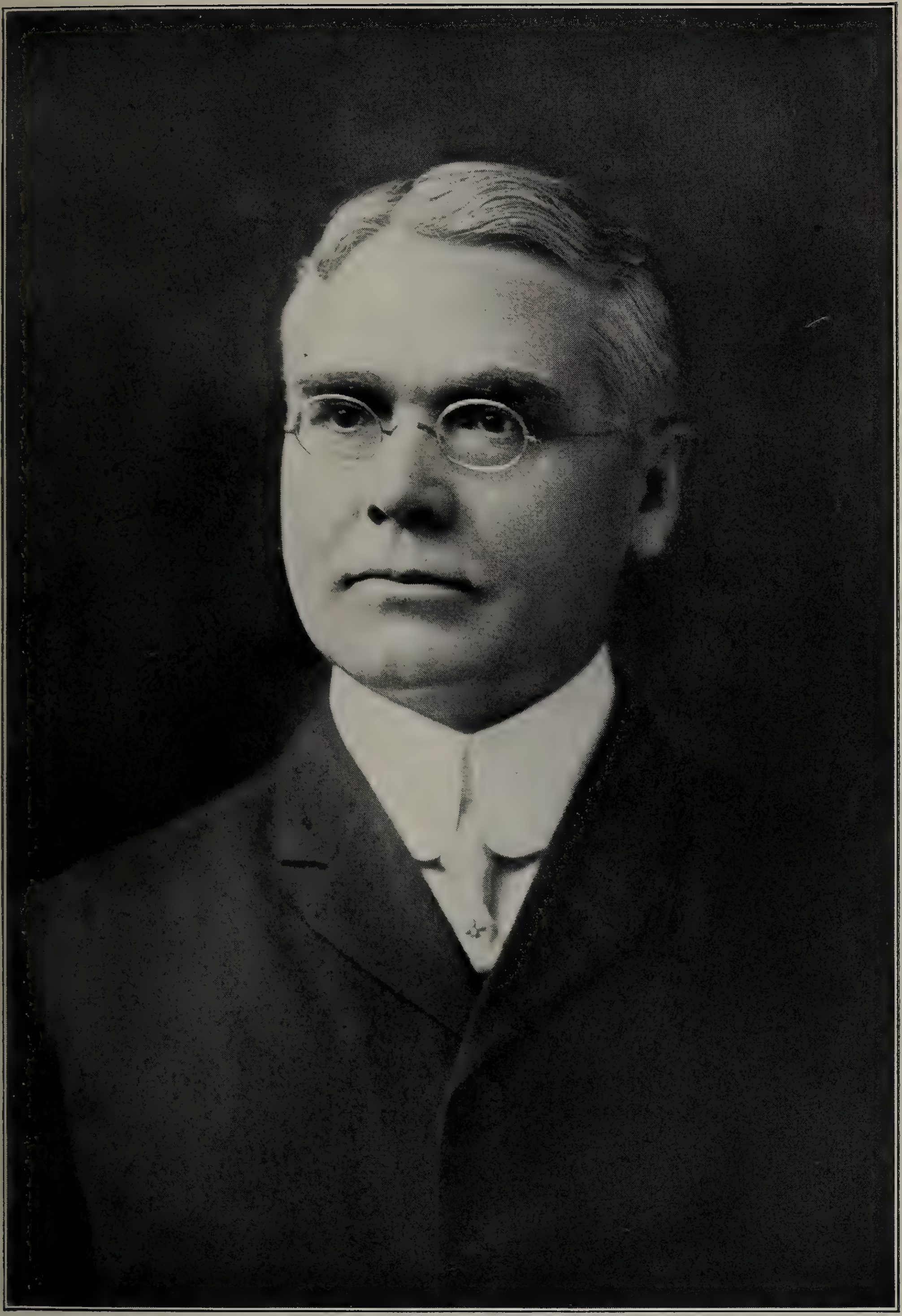
Dr. Thom and I busied ourselves especially with the endeavor to discover certain cases of normal-looking brains in epilepsy. We felt that if we could only find a sufficiently large series of brains without gross lesions, we should come upon the nucleus of the epilepsy problem, namely, those cases in which the origin of the epilepsy lay outside the nervous system, or in which the epileptic process was a submicroscopic chemical or physicochemical process in the nervous system. We published in the Review of Neurology and Psychiatry, October, 1915, a paper on this topic, finding, however, relatively few cases with normal-looking brains. One thing of note was discovered, namely, that those cases with daily or very frequent convulsions were rather less apt to show gross lesion than cases with occasional convulsions, or showers of convulsions. In short it is probable that the chemical or physico-chemical group of epilepsies would be cases of high frequency convulsions. The more epilepsy, the less there seemed to be to show for it in the gross.

The Monson staff has always been an exceedingly experimental staff in the direction of therapeutics, and practically every new proposition in the therapy of epilepsy has been studied and the results published. Many of these papers have been printed upon the presses of the institution itself and are available to interested inquirers. Even the claims concerning crotalin, for example, were investigated and found wanting.

Another situation which the epileptologist has to confront is the production every few years of an unfounded hypothesis or fantastical theory by some eager or designing worker in another field. The claims of a micrococcus, widely exploited in one of the journals with national spread, were reinvestigated and the claims proved baseless. A little course in the development of the theory of epilepsy would do almost any investigator good who felt over-inclined to jump to conclusions.

I have mentioned the work of Hodskins, Taft, Alford and Thom, and should mention in conclusion another pathologist, Dr. Herman Caro, now just beginning his work, so that undoubtedly the series of pathologists will be kept up under the enthusiastic interest of Dr. Everett Flood, who has unfailingly and upon all occasions co-operated and gone more than half way with the designs of the State Board of Insanity as embodied in the speaker.

In conclusion, I may say that besides the personal note which the institution always strikes with me, namely, the knowledge that it was an institution in which my worthy chiefs, Dr. W. N. Bullard and Dr. Owen Copp, had so important a hand, there is hardly any mass of material to which I personally go more eagerly than to the epilepsy material, knowing that it will throw some new light on obscure portions of every allied field. If one brings forward a proposition concerning mental disease in the narrower sense, or concerning feeble-mindedness, or concerning alcoholism, or concerning wider biological problems, it is always wise to ask would an analogous proposition be true concerning epilepsy. Thus, if I find that something like 10 to 25 per cent. of the brains of the custodial insane show no gross lesions, what is the situation in respect to epilepsy? With the same standards and criteria, it would appear that far more epileptics show normal-looking brains than do custodial insane. You can readily



Owen Copp, M.D.

First Superintendent, Monson State Hospital.

see that the explanation of these two correlative facts will bring up a host of problems and abolish a great many tentative conclusions which one might be inclined to make. I have recently been interested in the relative viability of different nerve cell types in the nervous system. I have tried to show that under certain circumstances, the giant cells of the cortex would withstand serious injury when the similarly large cells of the cerebellar cortex would surely die. This is a problem which has come to my attention in connection with the problems of organic epilepsy. I think the problem of the relative viability of different nerve cell types is one of the most fundamental of all neuropathological problems. Its solution would help the problem of epilepsy itself by giving us theoretical control of these cell types. By theoretical control I mean that the investigator would be greatly aided in his advance upon these most difficult fields if he were entitled to conclude that by the proper chemical or physico-chemical means, by way of the blood or cerebrospinal fluid, he could reach for solution of a certain type, had they indeed certain physical or chemical status, and perhaps protect them from toxines or faulty metabolic products. It is into some such deep and indefinite vistas that the neuropathologist looks when he comes away from the study of epilepsy. I hope and believe that the Monson State Hospital, together with a score of other institutions busy with epilepsy, will be led to continue their work for decades untold until a relative solution is obtained of the problems that we can now see in this field. Certainly we discover among the epileptologists some of the most rational optimists in the world. Although the present world outlook is dark enough, we are all entitled to deduce from a meeting like this that rational optimism will prevail.

THE MEDICAL VALUE OF OPTIMISM.

By Charles W. Page, M.D., Hartford, Conn.

It gives me great satisfaction to take an active part in the formal exercises which have been arranged to dignify this occasion.

I rejoice with the State officials, the medical profession and the well-informed public, because this hospital has done excellent work and is promoting high professional standards.

Then I feel especial pleasure in returning to-day to the spot where, as a medical student, I began my institutional experience, my life work in hospitals. Forty-seven years ago, when the State Primary School occupied this site, I was here, serving as hospital interne under Dr. Horace Wakefield.

The strong points of that able public official were honesty of purpose, devotion to duty, economical financiering and magnificent courage.

Naturally his strength of character and his resolute ways deeply impressed me, and then began the agreeable task of considering, in detail and combination, the mental ability, the moral ideals and the actuating force of those with whom I came into close association.

As illustrative of a habit thus formed I may refer to the fact that I came back to this institution about fifteen years ago and read a paper before the New England Society of Psychiatry, in which I endeavored to delineate the mental efforts and personal methods, with his patients, of another medical superintendent, under whom I also had the honor and the good fortune to serve an apprenticeship in hospital management.

That master of professional arts with the insane, Dr. John S. Butler, was an interesting study. In his daily ward work he evinced unusual insight into the springs of human conduct, and exhibited remarkable skill in adapting his mode of attack to the needs and susceptibilities of each individual.

The prominent traits of his strong character were fertility of resource, an infectious courage and over-ruling, optimistic philosophy.

Such attempts to analyze character, correlate a man's success and general progress, with the propulsive energy behind such good works, or large events, developed into habit; and as I have accumulated experience, especially with medical men, the more firmly have I been convinced that optimism is the chief constructive force in human affairs, and that its possession by a medical man is a requisite for professional success.

The power for good that resides in optimistic ideals and expectations is both positive and far-reaching. It has always been a matter of common observation that the personality of a physician largely determined his popular reputation, and that his successful management of certain classes of diseases could be predetermined when his relations to matters in general were characterized by common sense, confidence in himself, and persistent courage or intelligent optimism.

Through the constant activities in various ways of such a temperament, or habit of thought, a physician will not only take pleasure in his daily work and enlarge his interests in men and affairs, but he will be able to confer even greater blessings on those who enlist his compassion and come under his personal management.

A medical man who is well fortified with the optimistic personality is certain to meet with the most favorable conditions for developing in others hopeful, stimulating thoughts and moral courage, the best method by which to charm and invigorate the patient's mind, mollify his burden of ill health, and pave the way for improvement in bodily conditions.

The fear or conviction that one is sick naturally instigates the process of introspection, a pernicious license to the imagination, since such self-analysis too frequently aggravates subjective symptoms, generating morbid sensations and physiological anomalies or functional disturbances.

Such are the underlying conditions of mental and physical debility which most readily respond to judicious expressions charged with optimism.

In connection with tactful bearings and confident manners, the forceful use of right words can alter a forbidding aspect of the physical symptoms, as well as the fears and imaginings which chiefly constitute the common semi-invalidism met with.

To cope successfully with demoralized ideas of the anxious sick, as they crop out in all sorts and conditions of his patients, a physician with pronounced optimistic proclivity will find frequent occasion to exercise all the wisdom and wit he can command; yet no service he can render to disquieted invalids will be more efficacious or be better rewarded than will be the ingrafting into the minds of his patients feelings of courage and uplifting trains of thought.

Most properly can the sympathetic physician rejoice in his exceptional opportunities for doing good in this way while occupied at the same time in solving fascinating psychological problems.

If the benefits derived from optimistic suggestions by medical men were strictly confined to the mental improvement of their patients, then the ensuing peace of mind, incident to a revival of drooping faith and the re-enforcement of courage, would be adequate and satisfactory reward for the professional labor involved.

But our personal observations and the history of medical progress go to establish the fact that many physical disorders can be corrected by restoring a happy equilibrium in the relations of mind and body; and that a vast deal of human suffering may be abolished through fostering those mental ideas and forecastings that modify and stimulate the circulatory movements of the blood and the activity of the various glands.

That some subtile power of the mind indirectly applied, will change bodily conditions has been too well established to necessitate giving detailed examples at this time.

In one of his publications the eminent John Hunter asserted that "there is not a natural action in the body, whether voluntary or involuntary, that may not be influenced by the peculiar state of the mind at the moment." Dr. Tuke has elucidated the action and the power of the imagination in his remarkable work, "The Influence of the Mind upon the Body in Health and Disease." He has accumulated the history of case after case, giving detailed reports which illustrate the influence of the intellect on sensation, on voluntary and involuntary muscles and on organic functions in both normal and abnormal conditions.

Nothing could be more conclusive than his deductions. Then other reliable authorities have recorded the fruit of their observations on the same subjects, and with the same import.

They all recognize the operations of an occult power, a persistent mental or emotional force, which can be manipulated through the mind to control nervous action and produce physical results.

This provision of nature which gives significance to evolution in its higher sphere, to education and to idealism, or the supremacy of the human intellect, has been exploited throughout historical times and under cover of many successive medical schemes.

All such novel methods of helping the sick have utilized this universally acting, physiological principle; but the dazzling assumptions of the many new theories which have become popular at frequent intervals of time have overlooked or obscured the correct explanation.

Now, whatever success can be granted to such medical enterprises, it has been due in every case to the fact that, unwittingly no doubt, they trenched upon fundamental laws of growth and development, laws which pertain to the subconscious field of nervous action and physiological processes.

Then a critical examination of the methods of procedure adopted by the several phenomenal schemes of medicine will disclose the truth that one and all have been vitalized by a single agent, — the common germ of efficiency, or optimism.

Optimism is the great moral force which enables man to mold his career and shape events to his liking. It has immense power to pull or push in human affairs, and still it eludes all scientific methods by which to weigh or measure force. Optimism always carries an emotional equivalent, the mysterious power which can disturb, tranquillize or stimulate many vital processes.

The volume of this emotional wave varies with the degree of optimism entertained, and the energy it manifests depends upon the stage of concentration reached.

Hypnotism, in its various guises, has been much employed to charm away disease. Now the hypnotic subject has for the time being relinquished inclinations to question declarations or to reason on any subject; when, therefore, some monitor, infallible as he supposes, holds up a desirable end, the hypnotee lends all the force of his will and desire to experience or reach that optimistic end. His optimism for the moment is so positive and so intense it possesses the temporary value of objective reality.

Analogous states of credulity or rapt attention, with a corresponding quality of optimism, have been just as easily produced in persons who have become infatuated with bizarre and quasi-scientific medical delusions.

Again the predominating element of optimism is obvious in all faith, shrine, and other medico-religious devices. Indeed, optimism, raised to a sublime degree, is a characteristic feature of Christianity.

Under the spell of religious optimism, Christian martyrs have been able to disassociate mental perception from the plane of physical sensations, and absolutely disregard bodily conditions which ordinarily would be regarded as painful or even as torture.

Christian mystics have, by prolonged and intense contemplation of the crucified Christ, produced discolorations on their hands, simulating the wounds received by Him.

Sympathetic bruises have suddenly appeared upon persons who simply witnessed an accident, their deep emotional concern or expectation having produced the astonishing results.

In short there is ample, authentic evidence on record to prove the masterful ascendency which mental processes have over obscure, vital operations.

Fortunately for all invalids and for all men, those extreme instances of optimistic power, where religious fervor is associated with spectacular exhibitions of health-restoring potency, represent the limits of its usefulness in one direction only, and do not measure the sum of its benefits to man.

Cherishing optimistic ideals can in some positive way profit every person capable of thinking.

Notwithstanding medical science has located the material root of many acute and chronic diseases outside the sphere of mental influence, still the associated train of disquieted nervous and mental symptoms, so often observed with acute disease will always require an antidote, and counteraction is the most brilliant achievement of optimism. Morbid imaginations will fade from notice as optimistic anticipations preoccupy the mind.

To the credit of optimism it should be noted that the theory of a germ origin in so many diseases has been established as the reward of optimistic research, which thus encouraged has gone on with enthusiasm to discover more of the obscure agents of disease and death.

We all are under great obligations to those men who through their optimistic ambitions have brought light into the medical world, and in turn we owe our medical clients and one another all the good that we can impart through optimism.

Doubtless physicians, as a rule, appreciate the importance of the optimistic force, and do much, unconsciously perhaps, to supply this commonest need of their patients.

However that may be, still better results would be obtained if medical men would cultivate the spirit and study the arts of optimism, while endeavoring to disseminate it at every turn. And persistent work in these directions will be doubly rewarded, since a man's ability to instill optimism into the minds of others will increase with practice. Then the more of this "oil of gladness" that a man imparts to others, the greater will be his skill and pleasure in its distribution, while the more of it he bestows upon others, the more voluminous becomes his own reserve fund.

Providentially, the great majority of those afflicted with chronic disease can obtain a measure of consolation and some comfort through the power of optimism.

Helpless as may be their physical condition, and depressing as may seem to be their prospects, if they are not bereft of mental power, still much may be done to help them minimize and overlook the immediate impediments to their happiness. Optimism can be depended upon to soothe the troubled mind and bring a sense of satisfaction, and, best of it all, optimism is available when every other expectation has been disappointing.

Severely afflicted as one may be, the unfettered mind may be persuaded to entertain thoughts which will refresh and cheer the spirits. Optimistic mental excursions, calculated to defy the limitations of time, place and conditions, will be undertaken by bed-fast patients, when the several steps are depicted in attractive word-coloring by the sympathetic physician.

Optimism may be used to illustrate one's possibilities so clearly that a great sufferer, even, may be convinced that his mercies outweigh his trials, and that grounds for thanksgiving actually exist in his own case.

Ministrations of this character fall within the province of every physician; but when the field of his professional labor is within an institution, a medical officer redolent with sympathy and courage has manifold occasions for usefulness.

In public institutions are to be found masses of humanity, overwhelmed by disease, or other adverse circumstances, a pathetic group of unfortunate people, the majority of whom are in a helpless class, as respects benefit from ordinary medical treatment. Too often a hasty glance at such depressing objects, or a glimpse through pessimistic eyes, will suggest the uselessness of attempting anything in the way of alleviation with this forlorn class.

And yet, a medical officer with sufficient optimism to value the remaining ego of these human units, and to give reasonable consideration to their mental bias and reactions, can hardly fail to soften their distress of mind, supply fresh grounds for courage, and quite possibly be able to develop or revive their faith in the ultimate triumph of good.

All positive and expanding ideas of this order fairly glow with optimism, hope and expectation, and therefore constitute a powerful, healing force in the mind of the patient. And where the improvement of the physical condition is impossible, such an optimistic, uplifting, habit of mind is an important measure to secure, as it can but enlarge and beautify the horizon of the narrow world into which the chronic invalid has been forced.

All these possible products of applied optimism suggest the higher class rewards earned by physicians through genuine sympathy, benignant interest and wisely ordered speech.

But the chief hospital physician, the medical superintendent, whose relations with others are always qualified by the optimistic spirit, not only cheers and helps the inmates under his control, but his subordinate officers, the nurses and all employees will catch an inspiration from him, and attach a new import to their occupation, and, in consequence, they will conceive higher standards of duty, and increase the proficiency of their personal services.

Thus the entire population of the institution may be changed in spirit and performance by the light and cheer obtained through an optimistic management.

In hospitals where such is the established fact, the prevailing social atmosphere can be detected by an experienced observer, and upon slight acquaintance with the patients and the officers, because its resultant animation and hopefulness will be reflected from the faces of all, while the tone of their voices and their verbal expressions will harmonize with that benignant moral force.

The optimism here extolled is the confident hope of reasonable expectations, or an inspiration grounded upon a conviction of truth, the charm of high ideals and a fearless courage.

It practically magnifies the relative importance of promising possibilities by neglecting to heed the threatening ones, a simple but effectual application of the most profound philosophy which has been summed up in the admonition to "overcome evil with good."

Occasionally legitimate optimism may mislead a man's judgment, still it remains the best outlook to endorse, as it must ever continue to be the main compelling force to progress and the only policy that insures happiness.

When note is taken of those who are conspicuous for their habitual optimism only, this propulsive, expansive trait of character might seem to be a matter of temperament chiefly, a mental and emotional condition peculiar to a small class of extraordinarily endowed persons; but as a matter of fact, the large majority of human beings, at times and to some degree, act and react, mentally and business-wise, in accord with this regulatory factor of human nature. And it seems reasonable to hold that all such men can, if they desire to do so, put more ardor into their search for the actual and possible good in the world as they see it. Actuated by such a purpose they will read merit and honesty of intentions more and more into the character and actions of other men. In this way optimism can be acquired and its growth promoted by most men.

Certainly a sane man has power to decide what objects shall receive his interested attention. A microscopist can, as the result of choice, use the sight of one eye only when both eyes are open. Furthermore, he can restrict his attention to selected objects in the field of vision of the active eye, disregarding all light rays from other matter which constantly impinge upon the retina of each eye. Likewise a normal person should be no less successful if he actually prefers to entertain optimistic ideals.

Let him honestly engage in looking upon all sides of a question, and below the surface of dark things, even, with a view to discover something cheering, some neglected ground for hope, some indirect or remote benefit, possible of attainment, and such quests will be rewarded. With experience in this gracious work his discriminating faculties will acquire refinement, and his imagination will drift into constructive habits. He will discover and invent new points of view with fresh and charming outlooks. He will become expert in selecting fruitful themes for consideration, in projecting happy expedients, and in adding a vein of romance to prosaic affairs.

In medical work, where the mental attitude and the emotional activities play such important parts, the genius of an optimistic physician finds its most promising opportunities and its laudable triumphs.

It can operate for good in countless ways. It can substitute in the patient's mind objective realities for subjective vagaries, and it can lessen the bad effects from suspicion and superstition by preoccupying the mind with positive realities and substantial grounds for a higher faith.

Then it makes for his personal benefit, since optimism is the main dependence of the medical superintendent when his responsibilities weigh heavily upon him. Besides it will quicken him to appreciate whatever good work is performed by his medical staff and the employees. Finally, that harmony of interests which makes departmental teamwork agreeable and successful, that enthusiastic view of duty which makes service to others a source of happiness, and that ambition to excel in helpful ways which makes the most of a man's life, largely spring from optimism, diffused and personal, an auspicious condition, which ought to prevail in all hospital circles, but cannot be at its best unless the reigning authority possesses an optimistic insight and outlook.

EPILEPSY SHOWN BY MOVING PICTURES.

By Walter S. Chase, M.D., Boston, Mass.

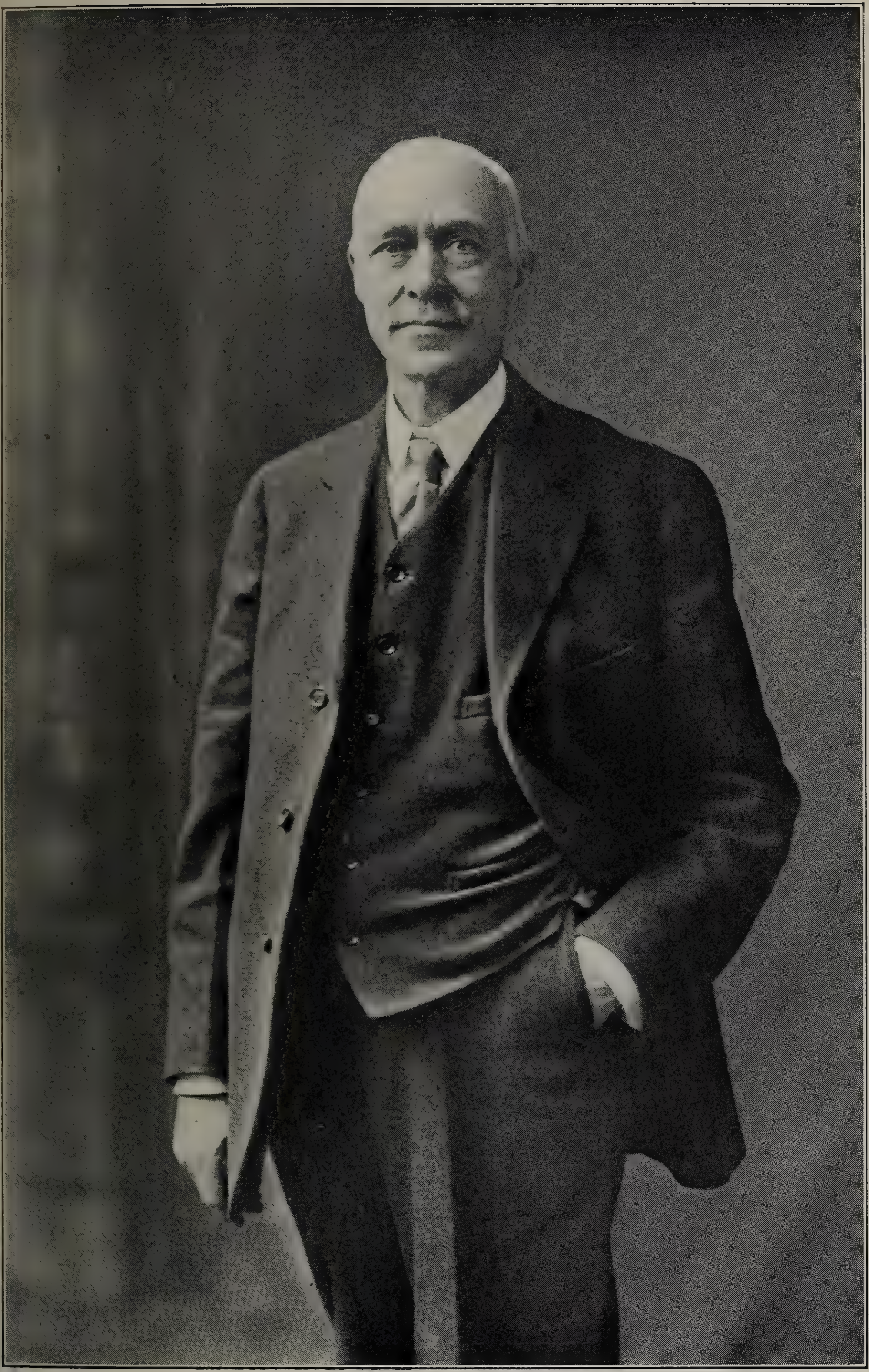
Dr. Flood has asked me to give some account of the manner in which I took the series of films descriptive of pathological motion, especially epileptic seizures; and while it seems to me that what work I have done in that line rather needs the illustration on the screen to make an interesting address, yet I am willing to contribute my share to the exercises of the day.

For some thirty-five years, as an amateur, I have been interested in photography. When, in 1884, a friend bade me farewell on the wharf at Sitka, Alaska, where I was to remain some weeks as a newspaper correspondent, he presented me with a small camera, and from that date I have photographed. Instantaneous photography was then unknown; but several were working on the problem of pictorially reproducing motion. The pioneer was Mr. Eastman, who has since developed the film, made possible moving pictures, and made the word "Kodak" synonymous with photography. The only approach to a moving picture was that made by Muybridge, who, by placing a series of cameras around a moving object, and making exposures serially a fraction of a second apart, produced the negatives which, printed on a strip and revolved in a cylinder with eyeholes, gave a perfect impression of motion. This was called a Zo-Opraxiscope. The next step in the production of the moving picture was perfectly logical. A flexible plate or film in a long strip, and capable of recording a series of continuous exposures, combined with an illuminated projector which shows on the screen each serial positive from these negatives for a very brief space, so brief that the human eye cannot appreciate the change, and you have the elements of the movie of to-day. Here is a piece of positive film, on which, as you see, the picture is only three-quarters by one and one-quarter inches, and it is this which is projected by means of a powerful light upon the screen.

I remember that in 1905 when on the way with other delegates to the Pan-American Medical Congress to be held in Panama, I discussed the idea, which had been for some time in my mind, of making moving pictures of pathological motion to be shown as an aid to instruction in those branches of medical science. The late Dr. McDonald, the alienist, or as we should now say, the psychiatrist, advised me to make a beginning with an attempt to portray an epileptic seizure, at the same time expressing his doubt as to the possibility of doing it. On my return to New York I called on the American Mutoscope and Biograph Company, one of the three pioneers in the manufacture of "film." They most courteously gave me facilities for getting points on the making of "movies." You will remember that at that time the "movie" was a rarity, one of the most common forms being something like the penny in the slot weighing machine, into which you looked at a short moving picture while turning the crank. Having invested in a camera, which would to-day be looked on as a clumsy affair, I went to Sonyea, N. Y., the only colony for epileptics of which I then knew. Dr. Spratling, who was then the head of the institution, put all the facilities of the institution at my disposal. I succeeded in getting two or three good seizures on the film, and returned to Boston to try my results. Later Dr. Flood invited me to his colony, where I obtained some good results, and we took some seizures under artificial light.

My first film was developed, and with the assistance of Thompson, the lantern manufacturer, we set up in his basement a projector which I had bought of the Edison people. I wonder if you realize the difference between that primitive projector which fitted in front of the stereopticon, and the modern "Powers," or Pathé projector, around the use of which are required all sorts of safeguards in the way of asbestos booths and fire prevention devices; for you know that if the film so much as pauses for a few seconds in front of the powerful concentrated light, it will catch fire, and there is nothing which will put it out quickly. When I think of the risks which I ran in setting up and running this projector while talking to medical meetings, I wonder that I am alive. I remember particularly at Albany, N. Y., where I was invited to give a demonstration before the physicians of that city in the opera house. There was only one man who could run a lantern in the city, and he was sick; so I had to set up my own lantern, run it from the balcony, and literally talk over the heads of the audience. Now, in order to exhibit motion films, I have to have a license as an operator, get a permit from the State police, have the machine enclosed in an asbestos booth, and comply with various and sundry other regulations, all of which are necessary to ensure the safety of the audience from fire.

I do not wish you to get the impression that the recording



Everett Flood, M.D.

Present Superintendent, Monson State Hospital.

of pathological motion and the teaching thereof was entirely original with me. Dr. McCoy of Brooklyn and Dr. Spratling afterward told me that they had for some time wished to illustrate lectures by this method, and had tried in vain to find some one with sufficient combined photographic and medical training to ensure good results.

To return to the first attempt, although doubtful of my result, I invited Dr. R. C. Cabot to come down and see the demonstration. We gave it, and as far as it went, it was satisfactory, — a perfectly typical seizure, with all the successive phases. I never will forget Cabot's remark as he turned to me: "Chase, that marks the beginning of a new era in medical instruction." I thought it rather an exaggerated idea at the time, but in view of the present development of the "movie," with its explanatory titles, the time will be not far distant when a class may sit down and see for an hour a lecture on pathological motion without a word from the professor. One obvious advantage is that of having your patient to show when the lecture is given. One prominent medical college every year sends for my series of films on epilepsy to illustrate the subject to the class, and several State committees have requested them to show in order to convince appropriation committees of the need of funds for establishing colonies.

As an illustration, when I showed the films at the meeting of the American Medical Association meeting in the hall of the new Harvard Medical School, I had just run through a reel on which there was a case of Huntington's chorea. While the reels were changing a doctor in the front row beckoned to me and complimented me on having secured such a typical case, stating that had he sought for one he could not get a better one to demonstrate before a class of students. I asked his name. As he handed out his card, on which was written the name of Dr. Huntington, he remarked casually, "I am the one who first described the chorea you have just shown." This is the kind of praise which makes one feel that his work is useful as well as entertaining.

I have been asked how I managed to get the seizures as I wished them. In the first place, having arrived at the colony, I spent some three weeks studying the patients and the problem, so as to get on the negative just the right moment and motion; also the right speed at which to turn the crank. Then the question presented itself, "how to be on the spot and have the camera adjusted to the right focus when the seizure occurred?" The camera which I had was a very cumbrous one with a fine lens and adjustment as fine as a Zeiss microscope. We selected a warm day and had some fifty men from the infirmary assembled outdoors and clad only in a blanket. An accurate focus was made on a dummy and marked. Then when one of the patients had a seizure, he was put on the marks and the crank turned. I assure you that to watch the subject while he is having a seizure, noting the points from both a medical and a photographic standpoint, and turning your crank at just the right speed, keeps one fairly busy for a few moments. In all, I have portrayed some thirty full seizures, and quite a number of cases of pathologic motion. One of the most curious cases was that of a patient with an exaggerated nervous tic, sent me by Dr. Morton Prince, and I think that I may say that he is my star "movie." Dr. Prince said, "Don't hestitate to give him a real razor and tell him to shave himself, as he does it every other day." I did, and the result was such as to make both myself and assistant afraid that we should be guilty of showing a suicide in a movie play instead of a scientific demonstration.

In regard to the expense, these films, apart from the outlay attendant on traveling and other incidentals, — merely the negative and positive which I show, — cost 22 cents a foot, and you can easily reckon up the cost of the hour's film at the rate of 1 foot a second.

I think that this tells the story of how I have portrayed epilepsy on the screen, and I hope at some time to see the "movie" play an important part in medical education. It certainly has a future in that line.

EYE WORK AT THE MONSON STATE HOSPITAL.

By George A. Moore, M.D., Palmer, Mass.

Eye work at this hospital has not been, during the whole of the twenty years in review, a matter of separate departmental activity.

Instead, aside from the regular incidental work, it has been prosecuted as a special work or study only intermittently. It apparently had not been part of the plan of the trustees to procure special service in this line, but about fifteen years ago Dr. Flood expressed his view on the importance of work in this department and from that time occasional work has been done and constant interest maintained. Eye work as a whole has been, therefore, of two kinds, — incidental and special.

Incidental has consisted of such attention to the eyes as seemed necessary or advisable for the preservation of function, comfort, well-being and appearance of the patient. This naturally included the careful measurement of errors of refraction and the correction of the same by lenses. We have not considered an approximation of this sufficient, but we have given a sphere, a cylinder or a compound where each was indicated instead of attempting to make spheres suffice for all cases for reasons of economy. Some patients are not in condition to accept this benefit, and despite an ocular need may not have glasses. All eye ailments have received prompt attention and a considerable amount of ophthalmic surgery has been done, which has included nearly all varieties of operations, except section of the globe as for cataract, etc. This latter has not been done because of the convulsive nature of the disease, — epilepsy.

Special work has consisted of studies of the eye in relation to systematic conditions. "A Study of Eye Strain in Epilepsy" (Hodskins and Moore, Annals Ophthal, 1905) netted no concrete positive finding, but rather tended to produce evidence that eye strain is a rather unimportant etiological factor in epilepsy. Before and since the time this work was performed, eye grounds have been studied from time to time. At no time was anything found in examination of eye grounds or function that could be associated solely with epilepsy, but changes in both were found which had relation to the disease with which these epileptic patients were afflicted. However, no conclusion has been reached that these changes either influenced or were influenced by epilepsy. In epileptic patients, as in others, particularly those suffering from syphilis, we often have found changes in appearance of optic nerve head and in nerve function.

Considering how frequent, in our State institutions, has been the finding of abnormal brains, and the reasonable certainty that a goodly per cent. of these patients now living will come to autopsy, it seems a reasonable thing to examine and record any changes in the grounds in a systematic attempt to correlate the appearance of eye grounds in life with such changes as may be found in the central nerve system at autopsy.

This attempt has been well begun, but, naturally, a long time must elapse before any appreciable result can be realized. But all endeavor thrives better on hope of some reasonably early fruition, and, in view of this, the relative frequency of changes in syphilis and the normal expectation of earlier autopsies in these patients, work upon them, as a class, is being attempted.

Laying aside for the time all abnormality in pupils and muscles, the most frequent finding in these cases is change in the optic disk, change in color being the most striking feature.

In an attempt to record changes in fundus, we must state in words or signs what is found or else make a drawing in color.

Obviously the latter can not be done on a large scale, so we must depend upon description.

Before proceeding we should speak, perhaps, of wide variation in color of disks in so-called normal fundi, because, despite changes ranging from slight pallor of a segment to a quite general blanching of the whole disk, function may be apparently unimpaired during a long period. The changes are often so striking that all that is needed to complete a diagnosis of pathologic change is impairment of function. We read in nearly every work on the eye or nerves of optic atrophy associated with tabes, general paresis, sclerosis, etc., until, if one takes inventory of these so considered disease entities and adds optic atrophy, a very good census of the results of neurosyphilis will be secured.

In examining the eye grounds of a known syphilitic, how natural it is, then, to pounce upon a whitened disk and promptly label it atrophy. It would seem better, though, if we were cautious in naming such a condition, with undisturbed function, atrophy in a non-syphilitic case, to be equally cautious in a known syphilitic. Surely we may not, on appearance alone, call one atrophic and the other merely white, pale or gray, if they are indistinguishable.

This raises the question of the limits of change in appearance in so-called normal fundi. Will more precise measurement of fundus and field reveal slight changes in these so-called normal cases. Measurement of visual accuity has a sufficiently well-recognized importance, but it is doubtful if the possibilities in measurement of indirect vision have been exhausted. If as has been said (I think by Von Gudden) no part of the visual area of the brain is unconnected with the macula lutea of the retina, we need not wonder that ordinary and indeed rather extraordinary lesions in the visual cortex may show no measurable corresponding defect in central vision.

If the so-called optic nerve, whose fibers have been shown to rise in the ganglion cells of the retina, loses conductivity of a few of its one million fibers, it still is understandable that central vision remains unimpaired.

The same may be said of other than macular fibers, but, carried to a more considerable degree, the indirect portion of the field shows variation in area, in color, and in form perception.

The writer believes that, even when the field is maintained so far as area and color perception are concerned, indirect perception of form may be interfered with, and hopes that invention of some instrument for determination of indirect form perception may help in discovering early departure from normal function.

Improved facilities and methods may show, if indeed present ones do not, that some abatement of functional activity is present in these so-called normal eyes with changed disk appearance, and that the difference in these cases is one of degree rather than kind. May it not be that because the intoxication of nerve cell in neurosyphilis is a persistent continued process atrophy from exhaustion becomes so extreme, and that a more transient form of intoxication from other cause may, while depleting the trophic power of nerve cell, yet not persist so long but many cells regenerate or recover to full power, and maintain as well the conductivity of their axonal fibers?

However this may be, in our work we intend making positive diagnosis of atrophy of optic nerve only when function is impaired, and will catalogue under other heading, until such change occurs, all other cases regardless of ophthalmoscopic appearance.

This word on eye grounds is a mention of the work and not a report. It seems well, however, to speak of it now and to report any progress made from time to time rather than to wait the necessarily long time before a complete report can be made; this is partly in hope that others may find interest in this same problem. In closing, it may not be out of place to speak of what one writer has called the epileptic eye.

The eye in epilepsy, so far as has been observed here, is marked by no distinguishing peculiarity.

AN ETIOLOGICAL STUDY OF A SERIES OF EPILEPTICS.

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AND

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This paper is a preliminary survey of a series of epileptic cases for the purpose of determining something about the nature of the material, the type of cases, the proportion of epileptics to general admissions, and other matters which are necessary before a more intensive study of isolated features in epilepsy can be made.

In attempting to analyze a group of epileptics as small as this series is, it was not expected that any valuable or lasting contribution to the subject of epilepsy might come out of it. By reviewing the present methods of studying cases in order to be able to revise them if necessary and to get some notion of the types of epileptics that predominate, we hoped, at least, to create a kind of framework upon which future studies might be based.

It is assumed that a group of cases taken from a general hospital and dispensary material would afford some features of particular value as contrasted with cases resident in special institutions, either State or private. It is this class of cases which has, as a rule, been made the subject of past study. Inasmuch as practically all the cases in the present material either came for treatment on their own initiative or were brought by parents or friends, they might be taken to represent with some accuracy both the occurrence of the various types of epilepsy and the proportion of epileptics to the ailing population, and probably, also, since the clinic is a large one, and has represented in it all the chief specialities, the proportion of epileptics to the population at large might possibly be deduced. There is an additional advantage to material of this sort, that is, easy access to specialistic consultation in the dispensary, and, if necessary, in the hospital itself. Finally there is the opportunity of studying the disease in its milder forms and in the initial stages. Therefore this material may be taken as representative of the material such as is seen by the general practitioner residing in an urban or suburban community. Thus far we have the advantages of this material. Two disadvantages, which are of some importance, must be mentioned. There is first of all the disadvantage of dispensary insufficiency, of the failure of patients to return after one or two visits, and, second, the disadvantage of the limited time which can be given to each patient. It is doubtless possible to overcome these difficulties to a considerable extent at any rate by giving to the patient on his first visit as much attention as possible, and later by placing all cases under the supervision of one member of the dispensary staff, who, by establishing the proper system and by having in mind the particular objects of the study, may so plan his work as to give him an efficient control over the material that he is particularly interested in. Such a system as this might eliminate certain defects which were found in the records in the course of the present investigation.

The cases first selected for study were those treated in the Washington University dispensary and the Barnes Hospital between the time of its opening, December, 1914, and March 1, 1916, — a period of fourteen and a half months.

There were 110 dispensary cases in which a diagnosis of epilepsy was made, and 24 hospital cases of which 10 were treated in the surgical wards and 14 in the medical wards. Of the dispensary cases, there were in addition 14 treated in the Barnes Hospital and 12 in the St. Louis Children's Hospital, thus making a total of 50 of the 134 cases in this series that were observed and studied in the wards of the hospital.

It was necessary to discard 25 of the remaining dispensary cases chiefly because of insufficient data, and for these an equal number of unselected cases treated in the dispensary since that time were substituted.

The proportion of epileptics to the general clinic population is about 1 to 200, and to the neurological cases 1 to 8. These figures are not exact as in some cases in which another condition overshadowed the epilepsy the latter diagnosis was not recorded. This, however, is not a considerable error.

The 134 cases have been classified according to etiology, as follows: cases without known predisposing or exciting causes and cases with etiological factors. In the latter a subdivision of definite and doubtful is made. The following table is of interest: —

Cases without known predisposing or exciting causes,	28
Cases with definite etiological factors,	80
Cases with doubtful etiological factors,	26

	Definite.	Doubtful.
Brain lesion,	23	2
Trauma (head),	17	6
Infectious disease,	7	2
Focal type of convulsions,	5	3
Labor,	4	–
Cardiovascular diseases,	3	–
Skull changes,	2	–
Intoxication,	2	–
Syphilis,	1	2
Alcohol,	6	–
Heredity,	5*	11†
Fright,	3	–
Anger,	1	–
Autointoxication (intestinal),	1	–
	80	26

* Direct. † Collateral.

This classification is made as a result of the natural grouping into which the various factors fell, and it by no means should be regarded as having any general value. With an increase of the number of cases studied, naturally other factors would have to be added from time to time.

It is often very difficult to decide which etiological factor is the more important. Munson has shown that inheritance is present as a factor in a large proportion of those who assign their difficulty to head injuries. Obviously alcohol and trauma are often associated, and in one of these cases there was in addition the factor of inheritance. In such cases the most direct or probable cause was the one selected for classification, and for the more intensive study of types, which is after all the chief purpose of this paper, this arrangement might be considered accurate enough.

Taken up in the order in which they attracted our interest certain factors in the above table warrant some discussion.

For a highly syphilized community syphilis seems to play an astonishingly small rôle in this series. Of the 104 cases upon which blood Wassermanns were done, 5 were positive. Of these, 2 were doubtfully positive, and the sera were later reported as negative, as were also the spinal fluids. One case gave a clear history of infection after the onset of the epilepsy, and in 1 case with syphilis of unknown duration, the epilepsy began three months after a fracture of the skull which produced hemiplegia and aphasia. At operation many meningo-cortical adhesions were found. This case was placed in the brain lesion group.

The 2 doubtful luetic cases were so classified on the strength of their histories alone: because of the death of eleven children when very young in one case; and in the other, a child of three years of age, because one brother is known to have had syphilis and another syphilis and epilepsy.

The only positive luetic case is that of a somewhat deficient twenty-two-year old boy who gave a history of typical grand mal attacks beginning at the age of seventeen and continuing at infrequent intervals until the present time. The pupils were unequal and reacted very slightly to light. The spinal fluid and blood Wassermann tests were both strongly positive, and the cell count in the spinal fluid was 241 lymphocytes. The patient also had albuminuria.

Thirty-five Wassermann tests were made from children of less than thirteen years of age, and 22 from cases in the idiopathic group. This result agrees very well with that of Thomsen, who found only 0.4 per cent. positive sera in 259 cases of epilepsy.

It will be seen that alterations in the cranium sufficiently definite to be considered important etiologically occurred in only 2 cases. One of these cases showed generalized hyperplasia, representing the skull changes in a marked case of rickets. In the other case the calvanium was irregular and moth eaten in appearance, very suggestive of luetic changes, in spite of the fact that the findings in the blood and spinal fluid were both negative.

In the remaining 57 X-ray plates nothing sufficiently definite to be considered abnormal was found. (Plates from cases of skull fracture and operated cases are not included in this group.)

We have been unable to confirm the conclusions of McKennan and Johnson, although 26 of the plates were made from cases in which organic factors were not suspected. It may be stated, however, that slight alterations that seemed to be present in the basal region were not considered. It has been noted in a number of instances that what appear in single plates to be variations in the neighborhood of the sella frequently are found to be artifacts when stereoscopic plates are made.

The largest number of cases in this classification is found in the brain lesion group. This includes 11 cases of hemiplegia or hemiparesis, of which 7, occurring chiefly in children, are of unknown origin. Three were due to the use of instruments at birth and 1 to skull fracture. In 4 cases, in which a high grade of mental deficiency was associated with the epilepsy, brain changes were assumed to be present, hence the case was placed in this group.

Of 4 cases operated on by Dr. E. Sachs in the Barnes Hospital, 2 were found to have gliomata, 1 cerebral meningitis, and the other a serous meningitis.

In 3 cases the findings were indefinite, consisting of obscure tremors and slight reflexes and pupillary changes that finally were decided to be cerebral in origin. One case was placed in this group because it presented the typical temporosphenoidal syndrome of Jackson, although no operation was done.

In the 2 doubtful cases definite symptoms of brain lesions were found, but there was not an opportunity to complete the examination.

In the traumatic group there were 9 cases of fracture of the skull without definite evidence of brain injury being found on examination. The interval between the injury and the first convulsion is respectively: twenty-four hours, six months, one year, two years, nine years, ten years, eleven years and "less than one year." Of the 3 cases with the longer intervals 2 had the focal type of convulsions, and 1 had a slight weakness and ataxia of one arm.

In 4 cases with history of trauma to the head, the first convulsion came within twenty-four hours, and in all within two weeks. One case of epilepsy occurred in a child one year old who had been delivered with instruments. In one case the first attack occurred five years after a head injury, at twelve years of age, that produced prolonged unconsciousness. In another the first convulsion occurred two years after injury, at twenty-three years of age. Unconsciousness had occurred also in this case. The attacks in this case were focal, the first attack occurring on a very hot day after a moderate amount of alcohol had been consumed. In the last case, a man of forty-four years of age, who consumed 2 quarts of beer daily, the first convulsion occurred two years after a severe head injury and upon a very hot day.

The last 2 cases illustrate the multiplicity of etiological factors that may be presented in a single individual.

Ten of the 17 cases in this group are twelve years of age or under. In 7 the attacks are wholly or in part focal in type.

In the doubtfully traumatic group are 6 cases, 3 of which are so placed because the relation of the convulsion to the trauma were not definitely stated in the history. One of the remaining 3 had the first convulsion two weeks after being rendered unconscious by a bullet which lodged against the superior maxilla. This patient likewise was in addition an alcoholic.

In another case the convulsions began at twelve in a child that had been delivered with forceps. A seventh nerve weakness of central type was found. In the last case the convulsions began at thirty-four in a man who used alcohol moderately. At the age of three this patient's skull had been fractured by the kick of a horse, and a deep depression in the frontal region remains as evidence of that trauma.

The infections assigned as causes are scarlet fever, scarlet fever and diphtheria together, tonsillitis, spinal meningitis and typhoid, each of these once. In only 2 cases does the presence of focal symptoms remain as evidence of the old brain lesion.

In the doubtful group one had the first convulsion three months after an attack of diphtheria, and the other had the first convulsion during a fever at twelve years of age.

Three of the focal group had convulsions limited to a hand or arm; one had convulsive movements that began in the tongue; and one had hemiepilepsy. The histories of the doubtfully focal group, while stating that convulsions occurred chiefly on one side of the body, are not explicit enough to establish this fact.

In the labor group are placed 4 cases, all of them without physical findings, in which the cause of the convulsion was given as labor. In 2 the first convulsion occurred during labor; in 1 two days after termination of labor; and in 1 a week after. Two of the cases gave a history of epilepsy in the parents, and 1 had migraine.

The three cases of cardiovascular disease require little comment. Two were old men with hypertension, enlarged hearts, etc., and one was a man of forty with nephritis and broken cardiac compensation.

Under intoxication are placed 2 interesting cases. One is that of a boy of twenty-two, who after a chancre received as treatment 9 injections of salvarsan, 16 of neosalvarsan, and 50 deep injections of mercury. During this course of treatment the patient developed epilepsy. The second a boy of fourteen has had convulsions off and on since infancy. The first convulsion is said to have followed an overdose of paregoric given by a midwife when the patient was only a few hours old.

Under heredity are placed cases with a family history of epilepsy for which no other explanation has been found. A number of cases in the other group gave a history of epilepsy in relatives.

The 1 case of autointoxication is that of a boy eleven years of age, whose sigmoid and rectum were found to be enormously dilated. The convulsions decreased in number when systematic rectal irrigations were employed.

It may be stated concerning the group of 28 cases in which no etiological factors were demonstrated that in several instances the records were found to be incomplete and that with a more thorough investigation etiological factors would doubtless be found in some of them.

The tentative results of this preliminary study of an outpatient epilepsy material is herewith submitted. It is evident that no conclusions derived from so small a material should be drawn. As a basis for further work in this particular clinical material, this preliminary survey should be of considerable value.

FOCAL AND GENERAL UNILATERAL BRAIN ATROPHY: EFFECTS UPON THE CORPUS CALLOSUM.

By A. E. Taft, M.D.,

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A favorable opportunity for pathological investigation of the human corpus callosum is afforded by cases of infantile hemiplegia. Institutions for epileptics not infrequently show marked examples, perhaps because whatever caused the hemiplegia (prenatal lesions, cortical hæmorrhagic encephalitis, perhaps poliomyelitic or the primary acute type described by Strümpell, or possibly other still more obscure causes) at the same time provoked the epilepsy.

The object of this study was to utilize epileptic material in the interest of the knowledge of the corpus callosum. This material was derived from the Monson State Hospital, and analyzed anatomically and by means of photographs, with the aid of the Massachusetts State Board of Insanity. Its most striking result dealing with (*a*) two cases of relatively *complete* unilateral cerebral atrophy, and (*b*) three cases of sharply defined *focal* unilateral atrophy, is the demonstration that —

(1) Complete unilateral atrophy results in a general diffuse thinning of the corpus callosum, and

(2) Partial unilateral atrophy entails a partial thinning of the corpus callosum in a region precisely opposite to the location of the cerebral lesion. Accordingly, one may suppose that whatever the ultimate origins or terminations of the corpus callosum fibers, they run in an approximately transverse direction while within the corpus callosum. Since our knowledge of the exact location of the cells of origin and the terminal arborizations of the corpus callosum fibers is at the present time very slight, it is clear that such a study as this may finally add to our knowledge of a very important problem — the physiology of the commissural system. The results of this study incline the writer to agree with von Monakow and others, that the parts of the callosum unite symmetrical areas of the cortex, rather than with Cajal, who believes that the corpus callosum is much more complex, and unites dissimilar areas. It may be that the corpus callosum does, by means of collaterals, effectively unite dissimilar areas of the hemispheres.

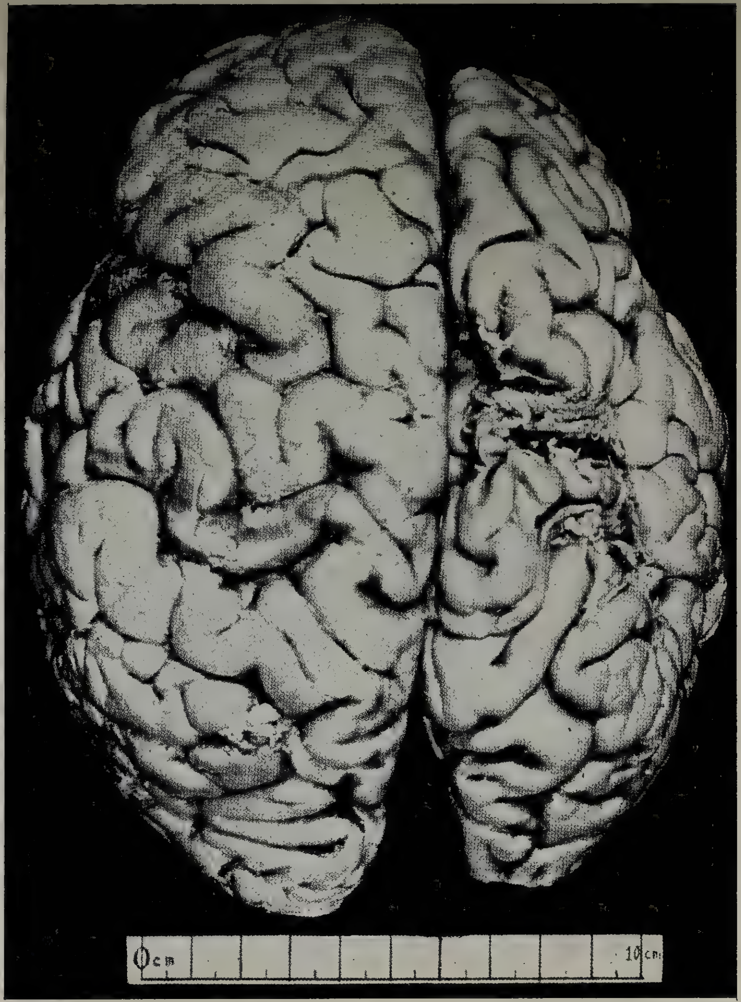

FIG. 1. — Top of Case 1, showing asymmetry, due to destruction of tissue in central region.

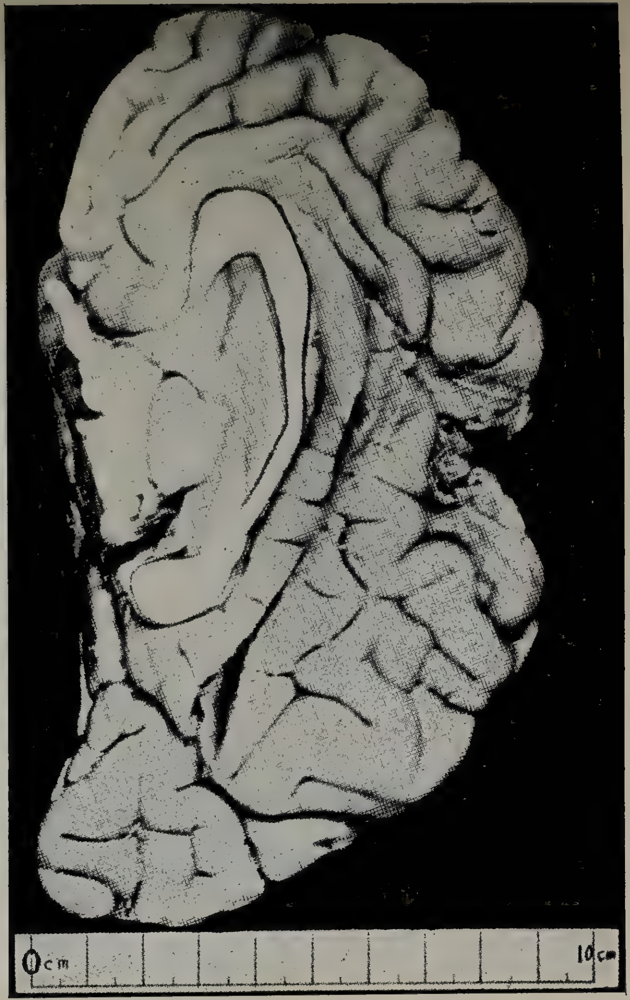

FIG. 2. — Mesial surface of Case 1, showing destruction of tissue in the region of the operculum, and the corresponding thinning of the posterior two-thirds of the body of the corpus callosum.

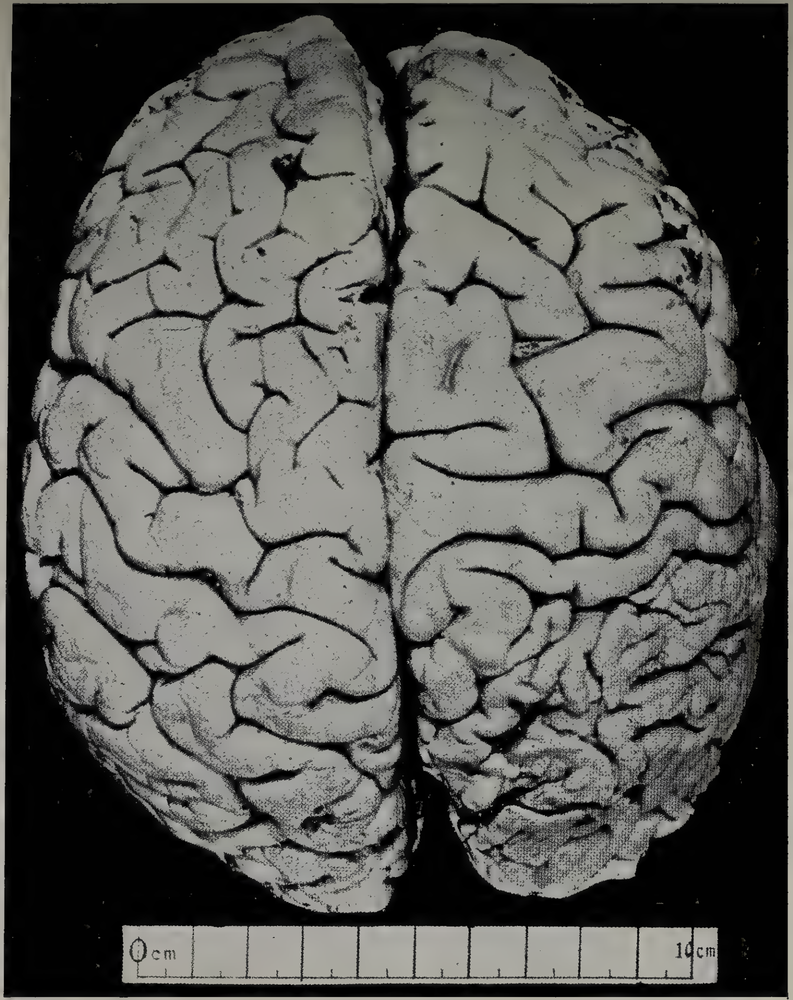

FIG. 3. — Top of Case 2, showing atrophy of the post-Rolandic region, and slight consequent asymmetry.

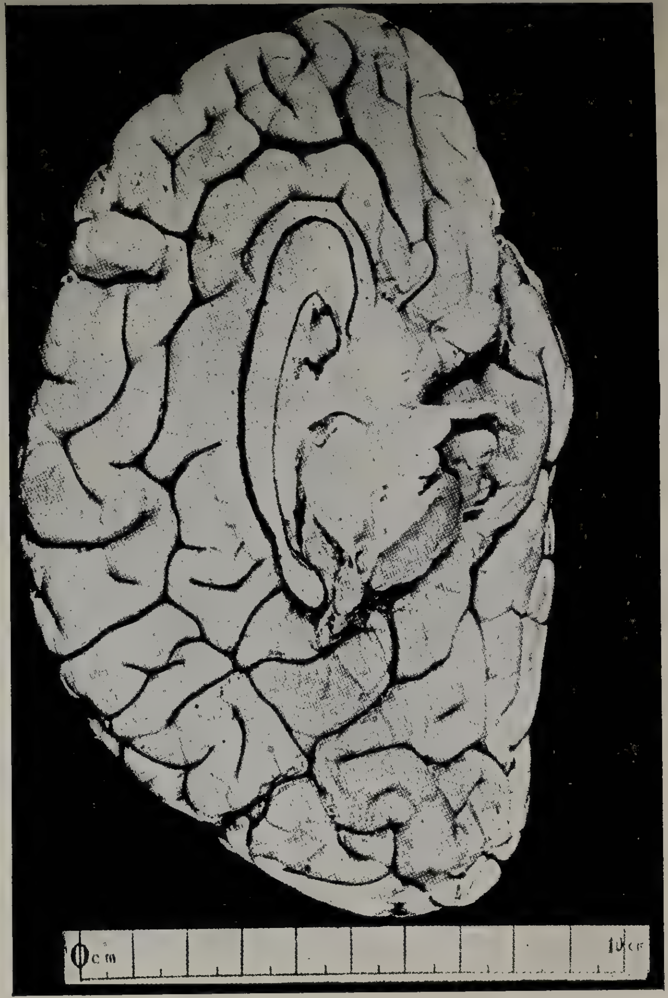

FIG. 4. — Mesial surface of Case 2, showing thinning of the corpus callosum just anterior to the splenium.

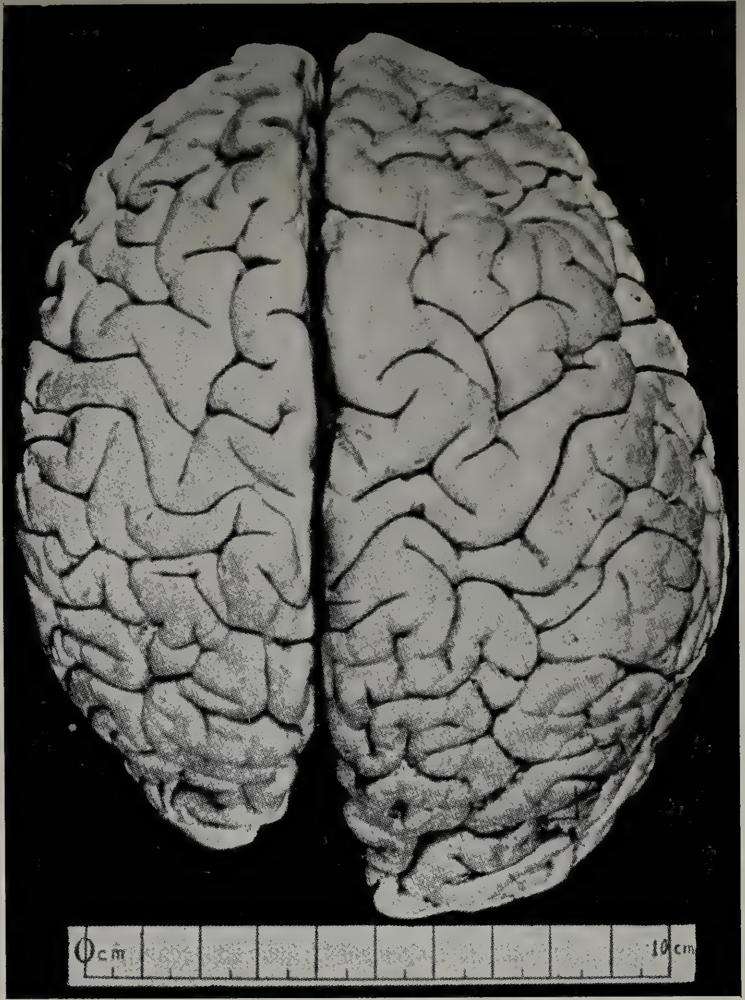

FIG. 5. — Top of Case 3, showing marked asymmetry, due to lack of development of the left hemisphere.

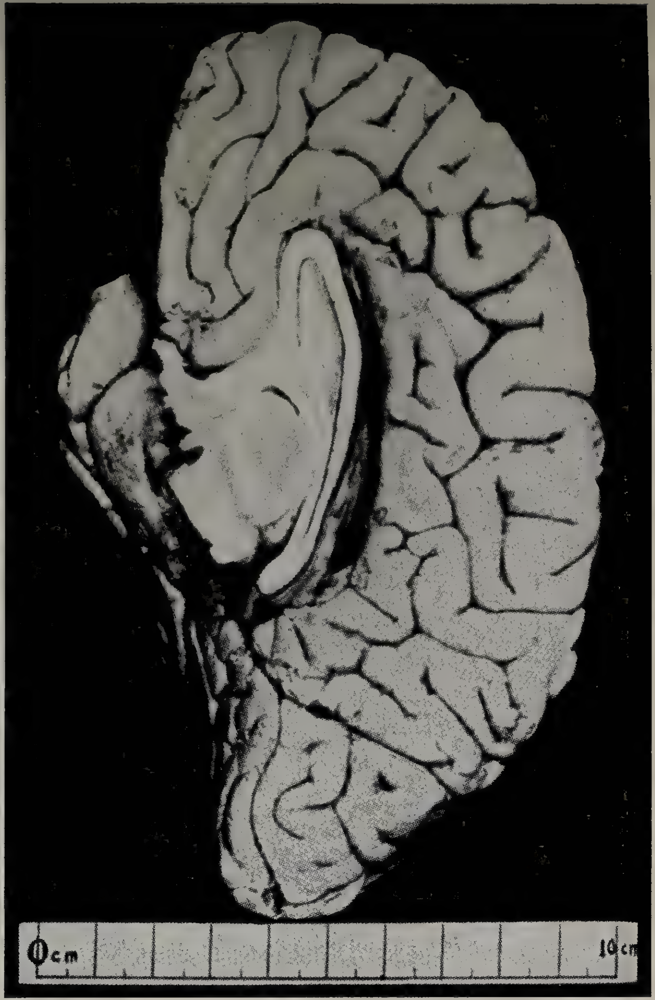

FIG. 6. — Mesial surface of Case 3, showing remarkable thinness of the entire corpus callosum, corresponding to the size of the left cerebral hemisphere.

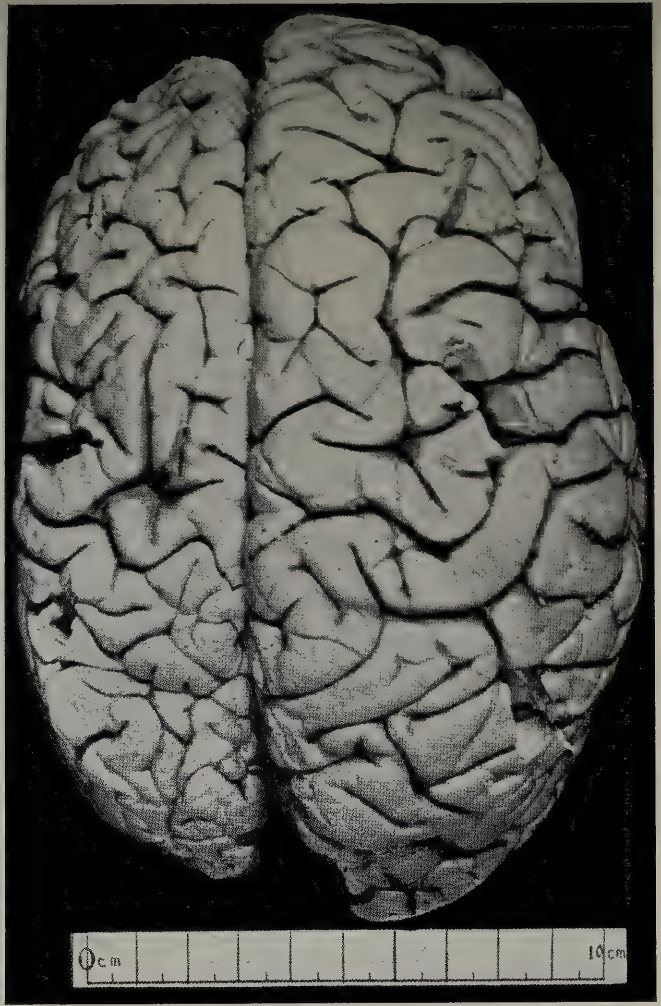

FIG. 7. — Top of Case 4, showing marked asymmetry, due to lack of development and retrograde changes in the left hemisphere.

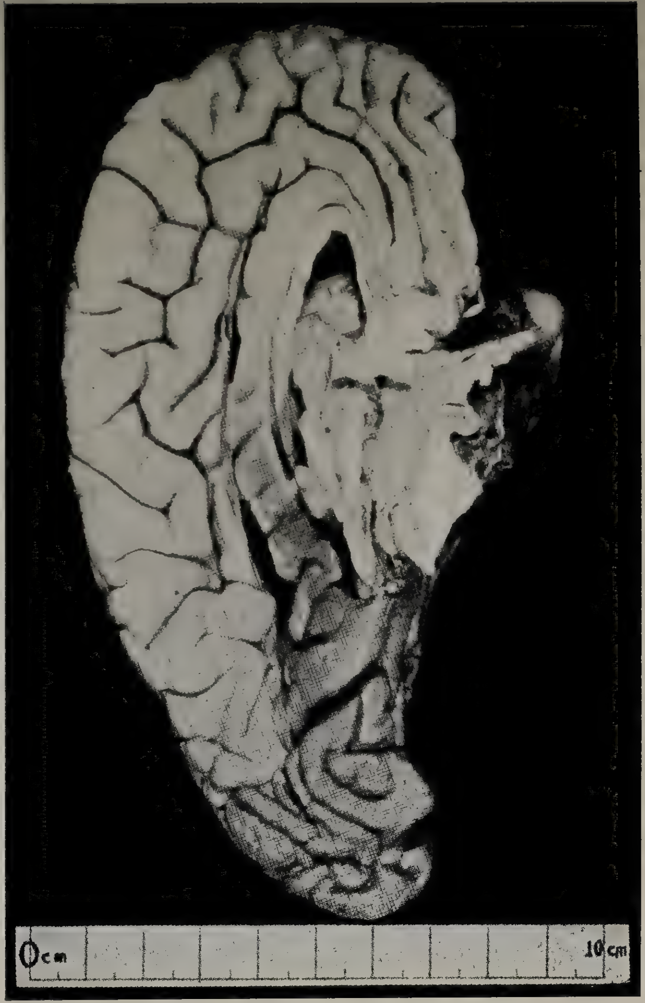

FIG. 8. — Mesial surface of Case 4, left hemisphere, showing atrophy of hemisphere, and corresponding thinness of the entire corpus callosum.

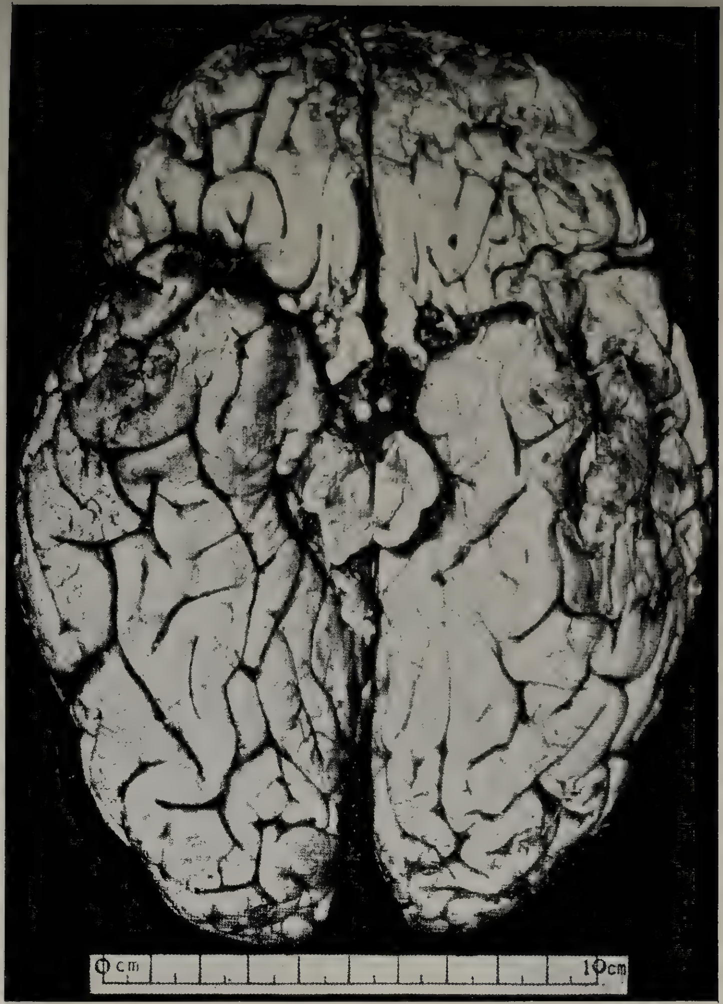

FIG. 9. — Basal surface of Case 5, showing areas of softening in the left temporal lobe, and on the left orbital surface.

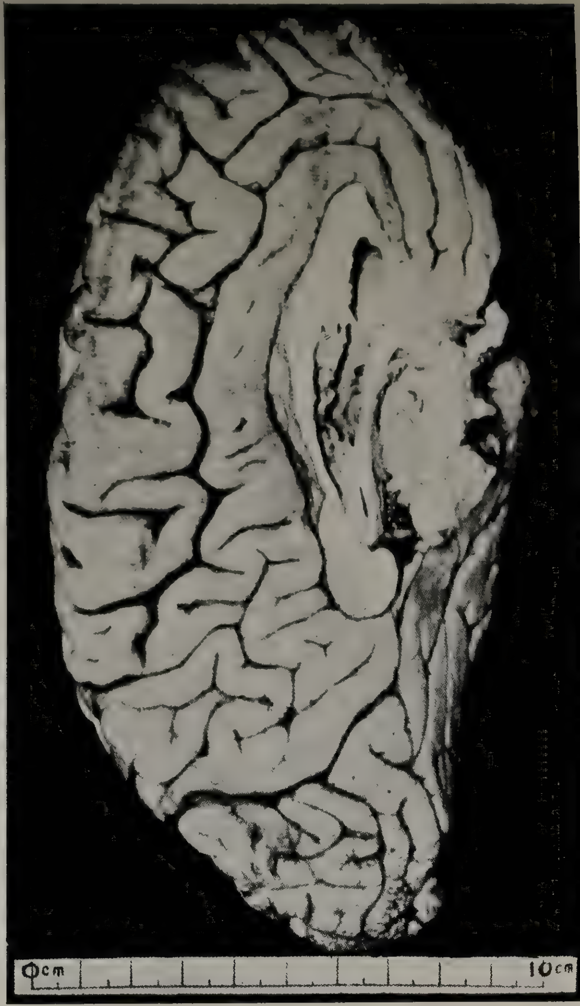

FIG. 10. — Mesial surface of Case 5, left hemisphere, showing marked thinning of the middle third of the body and subgenual portion of the corpus callosum, corresponding to the softened areas in the temporal lobe and on the orbital surface.

MATERIAL.

In 1912 the Monson State Hospital had its collection of formalized brains photographed as a permanent record, providing a possibility for detailed study from the anthropological-morphological point of view. At that time there were fifty specimens available. Twelve photographs were made of the surfaces of each brain; six with the pial membrane intact, including top, base, two lateral surfaces, and two mesial surfaces. After removal of the pia, the photographs were duplicated. In addition to this, in 25 cases the brain was cut in frontal sections, one centimeter or more in thickness, according to the proportions of the brain, and the posterior surface of each of these sections was photographed. Altogether, this makes a detailed, permanent record of a series of epileptic brains which is at the disposal of any one who may wish to make an investigation of the gross morphology at any time. Later, a much more detailed piece of work has been begun, in which sections from twenty-nine areas of the cortex of 25 cases have been prepared for histological examination, together with sections from cerebellum, medulla, and high cord. From the entire number five specimens have been chosen for whole-brain sections. These five are those which are the subject for special consideration in this paper. Each one of these cases presents a gross lesion mainly of one hemisphere. In detail they are as follows: —

CASE DESCRIPTIONS.

CASE 1. (11-26). — Female, nineteen years of age at death, duration of epilepsy, seventeen years. Mental classification, moron. On entrance, physical examination showed complete paralysis of left arm and hand, with contraction of wrist and fingers. The left knee was bent, but could be straightened. Left knee-jerks much increased and Babinski reflex positive.

The history of the epilepsy is, that at two years there was an illness called meningitis, at which time the patient had convulsions. Previously she had been as bright as the ordinary normal child of her age. Following this there were no further epileptic manifestations until the age of six years, when she had the measles. During this illness there was one distinct convulsion, and later she began to have staring spells, and slight convulsions which grew progressively more severe as she grew older. On admission to the hospital, four to ten attacks were occurring daily. They were said to be preceded by tachycardia. During the hospital residence of five years, there was a continuance of convulsions, varying in frequence and severity, accompanied by progressive mental enfeeblement. Death was due to status epilepticus.

The brain weighed 1,260 grams. It showed an extreme degree of asymmetry, due to much tissue destruction on the right side, involving the greater part of the central convolutions. Of this area, only the upper portion of the post-central gyrus, and the posterior half of the para-central lobule remain at all in a normal condition. Further, there is complete destruction of the supra-marginal gyrus, and a marked degeneration of the frontal operculum. This corresponds exactly with the paralysis present, and accords roughly, perhaps, with the degree of mental deterioration. The left hemisphere shows nothing remarkable in the gross. On palpation the cortex is soft and springy, suggesting a considerable degree of œdema, especially over the central convolutions.

On the mesial surface the most notable finding is the marked narrowing of the corpus callosum, for a certain definite segment of the horizontal portion, exactly corresponding to the cortical destruction in the right hemisphere, this includes the posterior two-thirds of the callosal body. In this part the width is only 2 millimeters, while in the anterior third it is 5 millimeters in width. This apparently represents the inter-hemispheral fibers, arising from the area of the cortex destroyed in the right hemisphere.

Case 2. (09-14). — Female, twenty-two years of age at death; duration of epilepsy, fourteen years. Mental classification, imbecile. Physical examination at the time of entrance to the hospital showed a left hemiparesis. Patient is able to use her hand in grasping objects, but cannot execute fine movements. There was a dorso-lumbar scoliosis, and some evidence of a left-sided facial paralysis. Reflexes increased. Sensory disturbance more marked in upper than in the lower extremities. An indefinite history suggests anterior poliomyelitis in childhood. During the six years of hospital residence the convulsions varied from four to forty-five monthly.

The brain, which weighed 970 grams, is fairly developed, but extremely simple in configuration. On inspection a marked degree of atrophy of the main part of the post-central gyrus is found, involving also the entire inferior parietal lobule, and all except the most anterior marginal portion of the superior parietal lobule. Frontal section through this area shows almost complete loss of substance, the wall of the hemisphere being reduced to the thinnest possible layer of tissue. The findings apparently correspond with the clinical signs. The motor disability probably depended more directly upon the sensory disturbance, as evidenced by the post-central gyrus degeneration, than upon absolute destruction of motor fibers. The loss of cortex in the inferior parietal lobule would result in loss of muscle sense, as shown by inability to execute fine movements with the corresponding hand, while retaining the ability to use it in a general way, more or less reflex in nature, as in merely grasping objects. Cause of death, status epilepticus.

On the mesial surface one may distinguish a sharply localized area of thinning of the corpus callosum, limited to its most posterior portion, and mainly affecting a very narrow segment of the body adjoining the splenium; the latter is also somewhat thinned. Thus one may easily suppose that this narrowed portion of the corpus callosum corresponds to the fibers from the atrophic area in the right hemisphere, crossing to the opposite side.

Case 3. (11-10). — Female, eighteen years of age at death; duration of epilepsy, thirteen years. Mental classification, idiot. Physical examination on entrance to the hospital showed a right hemiplegia; further details are lacking, and there is no early history, as there were no known relatives nor friends, the patient having always been, as far as known, an institution inmate. Cause of death recorded as epilepsy, probably not status epilepticus.

The brain weight was 740 grams. The convolutions vary notably in width and lack a rounded contour. The pattern is rather a simple one throughout. There is marked asymmetry, due to the very small size of the left hemisphere. There is no focal tissue degeneration, but a general lack of development, affecting mainly the post-central half of the hemisphere. Corresponding to this very small hemisphere, there is also a very thin corpus callosum, and this is true of the entire structure, including knee, body, and splenium; the rostrum is least affected.

Case 4. (11-7). — Male, thirty years of age at death; duration of epilepsy, twenty-eight years. Mental classification, imbecile. On entrance to the hospital thirteen years previous to death, the physical examination showed a triplegia, involving the entire right side and the left lower extremity. The brief history states that the onset of paralysis and epilepsy was in childhood, and there was complete inability to walk. The patient was also entirely devoid of intelligence. Death was due to epilepsy.

The brain weight was 965 grams. The right hemisphere shows a fair degree of development; the convolutions are fairly broad, but not well rounded. The pattern is simple. The left hemisphere is very much smaller than the right, involving all lobes. The convolutions are narrow, increased in consistence, and on section the cortex forms merely a thin shell, the thinning being particularly marked in the temporal and post-central lobes. The corpus callosum in this case shows similar appearances to those of the preceding one, but somewhat more marked in degree, with extreme thinning in all parts, corresponding to the general cortical degeneration of the entire left hemisphere.

Case 5. (09-23). — Male, eighteen years old at death; duration of epilepsy, twelve years. Mental classification, imbecile. Physical examination on admission to the hospital showed partial paralysis of the right side, with some difference in the degree of development of the two sides. Muscular co-ordination is said to have been fair; knee jerks increased. Unfortunately this brain was sectioned before the photographic work was done, so it is impossible to reproduce it, but a reconstruction from whole brain sections shows an extensive degeneration of the entire operculum, and the underlying first temporal gyrus, resulting in multilocular cyst formation, and an accompanying reduction in size of the entire left hemisphere. By the same means it is found that the corpus callosum is thinned out both in location and degree corresponding to the area of tissue destroyed in the left hemisphere.

To complete the picture of focal thinning of the corpus callosum, a case (15-63) is included which does not represent epilepsy, but criminal insanity. By the photograph it may be seen that with a great degree of softening of the cortex over the left temporal lobe and the greater part of the left orbital surface, the callosum is correspondingly thinned in the middle third of the horizontal portion, with the greatest degree in the posterior part of this area, and the rostrum also is markedly decreased in thickness.

Discussion.

The corpus callosum is made up of nerve fibers passing from one hemisphere to the other, in a transverse direction. The fibers of the posterior extremity (the splenium) are seen to connect the occipital lobes; just anterior to that, or the most posterior part of the horizontal portion, arise the parietal lobes; just anterior to this, the fibers have their origin in the temporal cortex; the middle part represents the central convolutions; the anterior portion, including the knee, passes between the convexity of the frontal lobes, and the subgenual part, or rostrum, is made up of fibers having their origin in the orbital surfaces. It has been said that this portion represents fibers only from the gyri recti, but it is plainly demonstrated by case 15–63 that this is not a fact, for here the gyrus rectus of both sides is only partly involved in the degeneration, while the remainder of the left orbital surface is very largely destroyed, with corresponding thinning of the rostrum.

Concerning the question of epilepsy in connection with these findings, it is interesting to review Strümpell's description of the development of infantile cerebral paralysis. He says that children of one and a half years and over, who previously have been both physically and mentally perfectly well, suddenly develop fever and headache. A few hours, or oftentimes a number of days thereafter, cerebral symptoms develop in the form of convulsions, unconsciousness, or other similar phenomena. After a varying number of days the child becomes perfectly well again, except for a persistent hemiplegia, varying in extent. The clinical picture points to an affection of a focus in the cerebral cortex, suggested by the paralysis with convulsions; the former is often confined to one side, and the epilepsy persists, and may be accompanied by athetoid movements. According to Oppenheim, the extent of the encephalitic focus may vary between very wide limits; it may be so small as to be recognized only with the microscope, or, in the case of infantile encephalitis, an entire hemisphere may be involved.

The onset of the disease is very indefinite in all of the five cases in this series; only in one, 11–26, is there a history of sufficient detail to indicate any febrile disturbance. The ages at onset, however, which vary between two and eight years, suggest very strongly that a focal or general infection of the brain cortex may have been the starting-point, resulting in a corresponding degree of paralysis, and causing epilepsy. Gowers says: "Of all the regional diseases of the brain in man, lesions of the convolutions stand almost alone as a cause of convulsions." The lesions of the convolutions in the cases considered here are quite apparent, and in these, as in other specimens, may find a definite indicator in the corpus callosum, when there is sufficient involvement to include the commissural fibers.

SUMMARY.

Five cases are considered, all of which were hemiplegic, epileptic, and mentally defective. The onset in these cases was between the second and the eighth year. Examination of the brains in every case shows a lesion of one hemisphere; focal in three cases, and involving the entire hemisphere in two. The location and extent of the cortical defect is indicated by an exactly corresponding thinness of the corpus callosum.

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BODY TYPES IN EPILEPTICS.

By Morgan B. Hodskins, M.D., Monson State Hospital,
Palmer, Mass.

I have been much interested in the work of Dr. John Bryant and Dr. Joel E. Goldthwait in their study of body types and the relation of these types to disease, especially their possible relation to epilepsy.

Bryant divides the human family into three types: the carnivorous, the herbivorous and the normal. Goldthwait, in the Shattuck Lecture for 1915, described these types fully.

In the lecture just referred to, Goldthwait says: "The characteristics are equally apparent in childhood as in adult life." Therefore, the study was first undertaken on young patients, with the idea that they were better prospects for treatment. The oldest patient in this group was twenty-four years of age, the majority being between twelve and fifteen years of age.

There are 115 patients included in this study, which, on analysis, gave 47 carnivores, 40.8 per cent.; 8 herbivores, 6 per cent.; and 60 normals, 52.1 per cent.

The causes of the epilepsy in the carnivores, as determined by the clinical examination, are as follows: idiopathic, 22; indigestion, 17; meningitis, 4; diphtheria, 2; hydrocephalus and alcohol poisoning, 1 each.

In the normal group the determined causes were: encephalitis, 16; meningitis, 10; cerebral hemorrhage, 7; birth injury, 3; rachitis, 6; blow on head, congenital syphilis, diphtheria, pneumonia and sunstroke, 1 each; measles, 2; idiopathic, 4; indigestion, 7.

On further analysis we find that in the carnivorous group, 10 per cent. were due to organic causes, and in the normal group, 60 per cent. In the carnivorous group we find six different factors to account for the onset in 47 cases. In the normals, thirteen factors account for 60 cases. Thirty-six per cent. of the carnivores and 48 per cent. of the normals had a hereditary tendency.

The average age at onset of the disease in the carnivorous group was 5.1 years, in the normals 2.85 years.

The group of 8 herbivores was too small for profitable analysis.

EPILEPTIC DEMENTIA.

By D. A. Thom, M.D., and E. S. Bundy, M.D., Monson State Hospital, Palmer, Mass.

In this note on dementia associated with epilepsy, we can do no more than summarize the data which have been collected in our study of the cases which appeared to be clinically certain dementias following the onset of convulsions. There is no claim made that they are what is generally termed "idiopathic" cases of epilepsy. We go no further than state that they present no clinical signs of organic lesions. Hystero epilepsy and psychic epilepsy have not been included in this study; the former cases, as a rule, do not terminate in dementia, while the psychic epilepsies are rare, especially in institutions. It is obvious, then, that we are discussing the epileptic as found in the institutions, — the epileptic who has convulsions and loss of consciousness, falls, froths at the mouth, bites his tongue, etc., — the epileptic who constitutes nearly 100 per cent. of all the epilepsies, and not the unusual case, which is often termed "masked" or "psychic" epilepsy. We were at first confronted with the problem of separating the dements from the aments, and, as a very large per cent. of the institutional cases present an abnormal mental condition on admission, this could be done only after a study of their early lives, special attention being given to their educational and occupational histories. Only those cases that had been able to support themselves and to conduct their moral and social intercourse with the outside world in such a way that they were not objectionable in the community in which they resided, were considered as having been at one time normal, and therefore subject to true dementia. Practically all the cases had their onset in early adult life, between the fifteenth and twenty-fifth years. A few give a history of convulsions during infancy with long remissions; while another small group had their onset after the twenty-fifth year.

It is our opinion that many of the classical descriptions of the epileptic have been drawn from rare and atypical cases, of often clinically uncertain epilepsy, which do not represent the epileptic as we find him in the institutions.

There appears to be some confusion between the epileptic personality, those inborn factors which are inherited, and epileptic dementia, those characteristics which are the result of abnormal brain functioning, long continued. To be sure, among the manifestations of epileptic dementia we must include an exaggeration of the epileptic personality, especially marked during the early phase of the deterioration. Yet, if we hope that the dementia of epilepsy will be a condition which can ever be differentiated from other dementias, we must go further and seek other manifestations of the mental aberration.

It may be necessary to dispel certain ideas, which have heretofore been held, relative to the epileptic. It may be the function of this paper to destroy what we believe to be erroneous impressions regarding this type of dementia rather than to advance any new diagnostic points. Yet, it seems wise that, in the process of reconstruction, the destructive tendencies should precede the constructive; so we shall consider a few of the common manifestations of the epileptic, and describe them as they have appeared to us.

1. *General Mental Impairment.* — The mental impairment of the epileptic, though invariably present, reveals marked variations in its mode of onset, the rapidity and severity of its course, and the relation it bears to the frequency and type of the convulsive seizure. There are a few cases who have had convulsions for years, and who, at the time of death, have shown practically no mental impairment; these cases usually had a late onset, the convulsions were rather infrequent, and the cases are relatively few. At the other extreme is the group of patients who, in association with frequent and severe convulsions, will go on to a complete dementia in a surprisingly short time. Between these two groups lies every possible stage of mental deterioration. In a general way, it appears that there is a direct relation between the number of seizures and the rapidity of the dementia. Yet, there are so many exceptions to account for, we are inclined to believe that it is not so much the frequency and severity of the convulsions as the original durability and stability of the nervous system; and, as one of us showed in a previous study of the dementias coming to autopsy, there is no relation between the clinical severity of the epilepsy and the pathological condition revealed at post mortem.

2. *Insight.* — The epileptic patient has only scant insight into his condition; he fails entirely to appreciate why he should be restrained from doing things that are obviously prohibitive; he wonders why he is not permitted to go out and earn his own living, notwithstanding the fact that he is having convulsions

daily. He has no fear in climbing trees and ladders, and in placing himself in hazardous positions. In spite of the fact that the dementia is rapid and progressive, he will tell the physician that he is quite as well as when entering the hospital, or, perhaps, improved; that he is not having convulsions and is anxious to go home. His judgment and reasoning are much distorted, as is shown in his daily routine life; his ability for planning and scheming is very limited; consequently, any attempts made against organized discipline are usually cumbersome and without effect.

3. *Irritability, Impulsiveness and Violence.* — These are three characteristics which are invariably attributed to the epileptic. Yet, as a syndrome, they are not always present. There is no question regarding the irritability of epileptics as a class. They are easily disturbed by trivial inconveniences, and are fault-finding and selfish. Jealousy is a very constant feature in their makeup and accounts for much of the trouble in their associations with other patients. Yet, there are not a few patients in our hospital to-day who have been subject to epilepsy for years and who are apparently free from any of the unpleasant characteristics of the average epileptic. Impulsion and violence in the epileptic has been much exaggerated. For a period beginning Oct. 1, 1914, and ending Oct. 1, 1915, out of a total of over 1,000 patients in the Monson State Hospital, only 85 different patients were placed in seclusion on account of their psychomotor activity. Excluding the cases at the children's colony and those of the lower mental grade, there remain 680 patients whose impulsiveness and violence might have subjected them to restraint, but whose conduct was such that such measures were not considered necessary. The fact that only 8.5 per cent. of our cases were restrained during the twelve-month period does not mean that there were not numerous other indications of irritability and impulsion; it simply indicates that the degree and character of the misdemeanors were neither violent nor brutal. Of the 85 patients placed in restraint, it might be stated that 28 were males and 57 females; 37 were restrained in order to prevent them from injuring other patients; the other 48 were locked in rooms to keep them from wandering about during post-epileptic confusion and injuring themselves or getting into trouble with other patients; 60 per cent. of the seclusion patients were either deluded or hallucinated. Their volitional disturbances, which are undoubtedly inhibitory defects, often find expression in an

aggressive psychomotor activity, which confines itself to the destructive realm, — often to breaking glass, dishes, pounding on doors, screaming, swearing and obscenity. The females, that is those who belong to the seclusion group, usually carry out their violence by scratching, biting, pulling hair, etc., while the men usually resort to fistic encounters. We have records of more brutal assaults with swabs, chairs, etc., and in one instance a patient, during a post-epileptic mania, used an ordinary jack-knife freely on attendant and other patients. But episodes of this kind, we are glad to say, are unusual. We do not agree with Bianchi, the Italian author, who states that "the whole life of an epileptic shows hatred; that it bursts forth in all its brutality on the slightest provocation; that the horrid, the brutal, and all that is evil, destruction and death, is present in his mind." Through the kindness of the medical director of the Bridgewater State Hospital, one of us was permitted to examine the records of 26 cases of epilepsy whose social conduct had brought them under the State's supervision. Of this number, 13 were committed on account of drunkenness, 4 for assault, 4 for vagrancy, 1 for larceny, 1 for murder, 1 for disturbing the peace, 1 for unnatural acts, 1 not criminal. Two of the cases for assault had been transferred from Concord State Reformatory, and the assault occurred during trouble with their keepers. The review of this small number of cases, although hardly a criterion upon which to judge the criminal acts of epileptics, would not lead us to believe that their tendencies were especially brutal.

4. *Delusions and Hallucinations.* — We are of the opinion that delusions do not play a very important part in the dementia of the epileptic; this being in marked contrast to the delusions in paralytic dementia is of particular interest. In a recent review of a group of cases coming to autopsy one of us found that delusions occurred eleven times in 38 cases, or 29 per cent. In our clinical cases we have obtained the following figures: in 386 females, 151, or 41 per cent., had revealed delusions or hallucinations, or both, during some period of their hospital stay. Out of 472 males, delusions or hallucinations were found 105 times, or 21.2 per cent. The fact that these active mental symptoms were twice as frequent in the females as in the males, and that in our study we found psychic attacks present nineteen times in 25 female cases and only once in the 25 male cases, leads us to believe that the psychomotor activity in the females may be due to the frequency of the delusions and hallucinations. Yet,

as previously stated, taking the epileptic as a group, that is, including 860 patients, we do not believe that the delusions are of marked importance. When present, bizarre in character, rarely fixed, and never systematized; usually they are persecutory type, seldom grandiose. Somatic delusions, though not as frequent as persecutory type, are more common and constant in epilepsy than any of the other psychoses. The content of the epileptic delusions is invariably shallow. If we may consider the fixed, systematized, constructive delusions of the paranoiac on one hand, and the superficial, changeable, wandering content of the epileptic's delusions on the other, we have the extremes. The latter are lacking in intensity and reality, consequently, they have little influence on the conduct of the patient. E. B. tells the physician that her arm has been broken, and at the same time uses it freely during the conversation. M. B. complains that the food has been poisoned, but goes to each meal and eats heartily. Another patient states that her relatives are in one of the adjoining wards, but makes little effort to see them. M. L. informs us that her relatives are of German nobility and that soon she will be very wealthy, but there she stops and does not continue to construct any grandiose ideas of what she will do when she gets the money. One can easily imagine the extent to which the general paralytic would enlarge upon such a foundation for a delusion, or what the constructive character of the paranoiac would build from that basic idea. But the delusions of the epileptic are constantly changing, making way for some other delusion of shallower content; they are invariably of unpleasant nature. The hallucinations are much the same type as the delusions, very elementary in character. Auditory hallucinations are perhaps more common than visual, and tactile hallucinations are comparatively rare. Notwithstanding the simplicity of the hallucinations in epilepsy, they have a force in determining the conduct of the patient that the delusions lack. One patient, M. S., on seeing bugs walking on the wall, becomes alarmed and terrorized and flees from her room. K. B. is directed by voices to hide herself away, which she does, seeking the most secluded places. T. G. becomes terrified at the imaginary presence in her room of a colored man; while M. C. is directed not to eat or drink, which she refrains from doing during her hallucinatory period.

5. *Religion.* — Most authors writing on the subject of epilepsy have called attention to the hyper-religiosity of these

patients. In our study of fifty unselected cases, 25 males and 25 females, with reference to their religious inclinations, we were not impressed by their spiritual devotion, either actual or assumed. Of the males there were 5, and of the females 6, who might be said to be religious; of the total of 11 patients, they all give histories of being deluded at times, but in only 4, or 36 per cent., of these cases were the delusions of a religious nature. In this same group of patients, 18 out of 50, or 36 per cent., had religious delusions. Thus it appears that those epileptic patients who were actually religious were not more likely to have religious delusions than those cases in any unselected group of epileptics; and, although delusions of religious type are common, associated with pre-epileptic and post-epileptic manias, there is no particular tendency for the epileptic to seek spiritual comfort during the intervals between attacks.

6. *Emotional Tone.* — Emotionally the epileptic may present every possible gradation from the deepest depression to the highest exaltation. Depression is by far less common than exaltation, and when it occurs is very apt to precede convulsions; while, during the post-epileptic manias, exaltation is invariably the rule. Both the depressed and exalted states are usually of short duration, the patient then returning to the usual state of mind, which is characterized by a dearth or lack of emotional tone. Disorders of volition, as previously mentioned, manifest themselves in the form of psychomotor activity and impulsive acts. The so-called manias, such as pyromania, kleptomania and dipsomania, are all occasionally met with, although not common. What per cent. of the alcoholic epilepsies could be classified as dipsomaniacs is a question. We are of the opinion that epilepsy and dipsomania are not commonly associated. The epileptic is easily influenced by suggestions and impressions, and is seldom negativistic.

7. *Orientation.* — The orientation of the epileptic often remains intact until the dementia is well advanced. This, of course, depends to a certain extent upon whether the patient's surroundings are changed during the dementing period. Various ideas of unreality, often regarding impending death, are common, but not constant or characteristic of epilepsy.

Disorders concerning the person are very rare, and they seldom exhibit ideas of reference.

Impairment of memory for recent events is a constant and early symptom; while the recollections of the remote past are often well retained. Typical amnesic periods are not common, though there is a marked disorder of attention which, in many cases, may assimilate amnesia. The intelligence of the epileptic is not necessarily limited, but is soon impaired after the onset of the convulsions. There is a certain degree of retentiveness manifested even after the patient's intake has been completely cut off. That is, many of the epileptic children who find it quite impossible to grasp new ideas or carry on any sort of elementary training at the present time will show evidence that they have retained considerable of the school training received previous to the onset of their convulsions, or during an earlier period when the convulsions, perhaps, were less frequent or severe.

There is at present a strong tendency, especially among psycho-analytic writers, to place epilepsy among the affective psychoses. They are inclined to make us think that it is the emotions and morals that suffer, and that the intellectual deterioration is of less importance. We are not of this opinion. Intellectual deterioration is perhaps the most common and constant factor in epileptic dementia, besides being very early in its onset.

That epileptic dementia is not an apparent thing, but rather, a deep, profound mental deterioration brought about in association with, or, as it may be, often independently of, the convulsive phenomena, is generally recognized. Yet, we do find an occasional case where the deterioration has been almost complete and which has made a wonderful recovery after the cessation of the convulsions. Such, however, is by no means the rule, and such cases justify reporting and often raise question of diagnosis.

A SECOND NOTE ON THE FREQUENCY OF EPILEPSY IN THE OFFSPRING OF EPILEPTICS.

By D. A. Thom, M.D.,
Monson State Hospital, Palmer, Mass.

Since publishing my early investigations concerning the "Frequency of Epilepsy in the Offspring of Epileptics,"* it has been my privilege to have the aid of a social worker to check up the results of my previous work. The fact that in only 8 of the 138 matings where one or both parents were epileptic did the offspring develop epilepsy was indeed surprising. Yet, when the ancestors of this same group were studied with the same point in view, direct similar heredity, there again were only 8 cases, or 5.8 per cent. But, as I explained in my previous article, the data I obtained was largely through correspondence and personal interviews with friends and relatives of the patients, and, therefore, subject to many sources of error; and had they not diverged so widely with the only other similar research work, that of Echeveria, published in the American Journal of Insanity in 1880, I should have hardly considered them worthy of publication.

The following table will show at a glance to what a marked degree our results differed: —

Investigator.	Married Epileptics.	Males.	Females.	Number of Children begot.	Died in Infancy, Convulsions.	Epileptics.
Echeveria,†	136	62	74	533	195	78
Thom,*	138	68	70	553	6	4

That 273 offspring out of a total of 533, or over 51 per cent., should have developed epilepsy seemed more startling to me than my own figures of only 10 epileptics in my total of 553 offspring, or less than 2 per cent.

So my purpose has been to make a more intensive study of the cases already reviewed, to determine if possible to what extent epilepsy is transmitted directly from parent to offspring.

The 33 cases I wish to report include 7 of the 8 matings where the resulting offspring were epileptic, and the total of 10 epileptic children include 8 of those reported in my last paper. In other words, the field worker uncovered 2 more cases of epilepsy in her more exacting study of these 33 cases than I did by my less accurate method.

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* Boston Medical and Surgical Journal, Vol. CLXXIV, No. 16, April 20, 1916.

† American Journal of Insanity, 1880.

Of these 33 cases, 13 were males and 20 females. Thirteen cases, including 11 females and 2 males, had their epilepsy before marriage; 19 cases, 11 males and 8 females, had their first convulsions after marriage. The 33 matings resulted in 133 offspring, 86 of whom are living and 47 are dead. Of the total of 133 offspring, there is a history of convulsions in 10, 5 having died in infancy during seizures, 2 becoming arrested cases, and 3 confirmed epileptics.

The causes of death in the cases of the deceased were as follows: —

Infantile convulsions,	5
Diphtheria,	5
Tuberculosis,	5
Indigestion,	5
Malnutrition,	2
Scarlet fever,	1
Purpura,	1
Meningitis,	1
Unknown,	9
Unascertained,	13
	47

The present age of the surviving children is as follows: —

Under 1 year,	1
Between 1 and 5 years,	10
Between 5 and 10 years,	14
Between 10 and 15 years,	10
Between 15 and 20 years,	11
Over 20 years,	40
	86

This group of living offspring whose parents, one or both, were epileptic contains 46 cases still under twenty years of age and in the epileptic zone. What per cent. of these cases will develop epilepsy no one can say at this time, but it is not probable that it will be 50 per cent. Of the cases over twenty years of age, heredity will play a much less important part. So it appears that the results of the earlier work have been to a large degree substantiated by this more intensive study, and that the conclusion that epilepsy is less often transmitted directly from parent to offspring than we have heretofore been led to believe is justified.

ALCOHOL AS A FACTOR IN THE PRODUCTION OF EPILEPSY AND ALLIED CONVULSIVE DISORDERS.*

By D. A. Thom, M.D.,

PATHOLOGIST, MONSON STATE HOSPITAL, PALMER, MASS.

Alcohol as a factor in the production of epilepsy and allied convulsive disorders may have its origin in either the parents or the patient. I am skeptical only regarding the effect of alcohol when found in the collaterals or grandparents.

The use of alcohol by the parents may occur in any one of the three following ways: first, chronic alcoholism in one or both parents; second, acute intoxication of one or both parents at time of conception; third, the use of alcohol by mother during pregnancy.

Chronic alcoholism in one or both parents is undoubtedly responsible for no small percentage of the hereditary epilepsies; while acute intoxication at time of conception and the use of alcohol by mother during pregnancy would account for but a relatively small percentage; yet, they must be considered in a discussion of this kind.

Dr. Matthew Woods of Philadelphia reported in the Journal of the American Medical Association, Vol. LXI, No. 26, 7 cases of epilepsy in children traced to a single intoxication on the part of one or both parents at time of conception, otherwise teetotalers. The cases were outlined so briefly and the impression was given that so much had been taken for granted by the author, that one was inclined to feel that he had been asked to accept much on little evidence. Tredgold states that Demereaux, Dehant and Doison have traced cases of epilepsy to an alcoholic intoxication at time of conception. On the other hand, he goes on to quote Dr. Ireland, who found that in some parts of Scotland, where it was customary for whole villages to get drunk at New Year's time, that it has never been noticed that the resulting children were idiotic. He also mentions that a similar celebration takes place at the end of the fishing season, without noteworthy results.

To my mind, the study of a large group of cases, such as came under the observation of Dr. Ireland, is far more convincing than the selection of a few isolated cases here and there and using them to prove the point in mind. Yet the question is by no means settled, and it will be well to keep it in mind when taking family histories, as one of the possible predisposing factors of epilepsy.

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* From the wards of the Monson State Hospital.

Perhaps the skepticism in my mind may be due to the fact that I have yet to see a case of epilepsy where I believed that an acute alcoholic debauch by the parents (which was not an acute exacerbation of a chronic condition) was its origin.

It is quite conceivable that the use of alcohol by the mother during pregnancy may so affect the development of a growing fetus that a nervous system of impaired durability and stability may result, manifesting itself in epilepsy, feeble-mindedness, or, perhaps, some other neuropathic taint.

The following case which came under the observation of Dr. Tredgold, in which the alcoholism resulted in amentia, offers a good example: —

> The father was a hard-working, industrious man, sound in body and mind, and coming of a healthy and long-lived family; he married the daughter of a small publican, apparently a healthy and happy girl, who used occasionally to serve behind the bar. Shortly after marriage this girl developed an insatiable craving for drink; all the money she could obtain by any pretence whatever went in procuring it. Later, the ornaments and then the furniture of the house were pawned to feed her desires. Ten months after marriage she gave birth to a child, a hydrocephalic idiot; and according to the husband, she had scarcely known a sober moment during the preceding four or five months. Further inquiry showed that this woman's father was also a heavy drinker, but otherwise there was an entire absence of any neuropathic condition in the family.

He goes on to state: —

> It may be that the alcoholic taste of the mother was in itself evidence of the neuropathic diathesis, but I cannot help thinking that the child's condition was more largely due to an actual poisoning during its intra-uterine existence, and this view seems to be supported by the subsequent history, for the next child that was born, after an interval of nearly two years, was perfectly normal and is now a bright and intelligent boy of eight years; by this time, however, the mother had recovered and had lived a perfectly steady life during the whole of the pregnancy.

A word further might be said regarding chronic alcoholism and its relation to epilepsy. The fact that alcohol in the parents was responsible for a certain amount of the epileptic offspring has long since been established, and, in many cases, undoubtedly exaggerated. Dejerine claims that in France over one-half the epilepsy in children is due to alcoholic parents. Stuchilk writes from Bohemia that his study of family histories of 176 epileptics showed alcoholism in one or both parents, 36 per cent.; among the grandparents, 38 per cent. He states further that in 50 per cent. of the cases in which parents were alcoholic, the collaterals and grandparents were healthy. Binzwanger attributes 22 per cent. of the epilepsy in Germany to alcoholism; while, in this country, Spratling, from the Craig Colony, gives 14 per cent. My own tables, compiled from the records of Monson State Hospital, showed that 14.6 per cent. of the cases with heredity may be attributed to alcohol.

To be sure, alcohol was found in other cases, but always associated with some other genetic factor. I am sure that no one in this country who has had very broad experience with epilepsy will agree with Matthew Woods in his claim that alcohol explains 35 per cent. of the epilepsies. I think that, in this country, between 10 and 15 per cent. of the institutional cases might find their genesis in alcoholic parents, but I should not expect it to be doubled or trebled in France. Carl von A. Schneider, M.D., very aptly states, in his article on "Studies of Alcoholic Hallucinoses," reported in the Psychiatric Bulletin of the New York State Hospital, Vol. IX, No. 1, that "Alcohol as an hereditary and etiological factor in the production of insanity has been overrated." I am sure this statement applies to epilepsy as well as insanity. The remaining portion of this paper will consider alcohol solely as an etiological factor: first, by acting directly upon the nervous system usually predisposed by hereditary taints and producing convulsions in a comparatively short time; second, by effecting intermediate changes outside the central nervous system, of which chronic kidney disease and arteriosclerosis are the best examples.

This latter group of cases is too far removed from the province of psychiatry or neurology to be of special interest to us at this time. It may be said, however, that the onset of convulsions in this group is usually late, often occurring in the fifth or sixth decade. Seizures associated with chronic kidney diseases may occur earlier. They are usually of the grand mal type, are apt to occur in a series, and are not often associated with mental deterioration, many of these cases dying in coma following convulsions. The convulsions associated with arteriosclerotic cases, or, more specifically, cerebral endarteritis, do not usually occur in series and are usually associated with dementia. Many of these cases die from cerebral hemorrhage following a convulsion.

I am cognizant of the fact that I am subjecting myself to criticism, perhaps on the ground that alcohol is not a definitely established factor in the production of either chronic kidney diseases or arteriosclerosis, but until we are able to establish a better etiology for a large group of toxic kidneys I am willing to accept the alcoholic origin, and while I am willing to concede that the relation between alcohol and arteriosclerosis is still problematical, I believe it is worthy of consideration. The last group of cases which enters into this discussion are those in which alcohol acts as the exciting factor in the production of the convulsions. In fact, in some of these cases, it appears to be the sole cause.

Notwithstanding the fact that we are often unable to establish any cause for the convulsions other than alcohol, I am strongly of the opinion that in a perfectly stable and well-adjusted nervous system alcohol per se is not sufficient to produce convulsions. To be sure, had the patient not indulged in alcohol that factor as an exciting cause would have been removed, and it is fair to assume that the patient would not have suffered from convulsions, unless, perchance, some other extraneous exciting factor were encountered. Yet, as practically all the cases of alcoholic epilepsy occur in men and almost always late enough in life to avoid most of the shoals upon which the predisposed are usually wrecked, we have no reason to doubt the foregoing assumption that the epilepsy in the following cases is justly attributed to alcohol. I will cite, as briefly as possible, 5 cases which divide themselves into two groups: —

1. Cases that have come under institutional care early after the onset of the convulsions (usually within four years).
2. Cases which have had convulsions for several years before coming under institutional care (often over six years).

GROUP I.

W. K. Admitted March 23, 1914. Age, thirty-one. Occupation, laborer. Education, first year grammar school.

Family History. — Father died at sixty-five of heart failure. Mother died at fifty-one of Bright's disease. Family history otherwise negative.

Personal History. — Birth normal. Had scarlet fever at twenty-eight; measles in infancy.

Physical and Neurological Examination. — Negative, excepting for impaired hearing in left ear.

Urinalysis and Wassermann test negative.

Epilepsy. — First convulsion at age of thirty-one; duration of epilepsy before admission, four years.

Hospital History. — Patient had first convulsion during the fifth month after admission; has had none since July, 1914. He has worked every day since admission to hospital as a painter. His work is efficient, he is trustworthy, shows no evidence of irritability, impulsiveness or violence, and is not demented.

A. L. Admitted Dec. 3, 1913. Age thirty-five. Occupation, salesman. Education, high school.

Family History. — Father died of heart trouble at age of sixty-four. Mother is living and well, age, sixty-seven. Two brothers and two sisters living and well. Family history negative.

Personal History. — Birth normal. Had scarlet fever at nine years of age.

Physical Examination. — Negative.

Urinalysis and Wassermann test negative.

Epilepsy. — Began four years previous to admission. Attacks generally occur at night. Patient had always been a heavy drinker, and had been using alcohol to excess just previous to first convulsion.

Hospital History. — Patient had three attacks during the first month here; had another attack eleven months later; another five months later, and still another four months later. Has had no seizures for the past six months.

He has worked steadily since admission in kitchen and bakery. His work is efficient, he is even tempered and shows no evidence of dementia. All of the convulsions since admission to the institution have been preceded by drinking sprees, patient leaving the institution grounds without permission, going to town and purchasing liquor.

V. B. Admitted May 2, 1914. Age, forty-three. Occupation, laborer.

Family History. — Father died from gangrene. Mother alive and well. One sister living and well.

Personal History. — Labor normal. Patient had one convulsion during dentition. Had measles and whooping cough; otherwise, medical history negative up until onset of convulsions.

Physical and Neurological Examination. — Negative.

Urinalysis and Wassermann test negative.

Epilepsy. — Patient had first convulsion at tenth month; remission of thirty-eight years, when they began again, always being preceded by alcoholic sprees.

Hospital History. — Patient had one convulsion during first month here, then remission for six months; had second convulsion during seventh month, then another remission for six months; then had two convulsions, and has had none since July, 1915.

He has worked efficiently about the grounds since admission, and has abstained totally from the use of alcohol. He shows slight mental deterioration in the form of memory defect.

Group II.

J. G. Admitted May 26, 1910. Age forty-five. Occupation, clerk. Education, grammar school.

Family History. — Father died at seventy-two of old age; mother died of indigestion at age of seventy. One brother insane.

Personal History. — Birth normal. Had measles and whooping cough. Medical history negative until he was twenty-four years old, when he had empyema following pneumonia.

Physical Examination. — Negative, except for marked constipation and evidences of arteriosclerosis. Following the death of his mother, four years previous to admission, patient began to drink to excess; as a result, was committed to Foxborough State Hospital. He remained there for a period of two and a half years, and during part of the time he was given slight financial recompense for his services. Grand mal attacks began after the excessive use of alcohol following death of his mother.

Hospital History. — Patient was in the hospital six months without convulsions, left on visit Oct. 20, 1910, remained away until Jan. 24, 1911. He had one convulsion six months after return, and they have persisted regularly ever since, with a few exceptions. He seldom has more than one grand mal attack, and during this interval has gone seven months without any seizures.

E. H. Admitted June 18, 1909. Age, forty-eight. Duration of epilepsy, ten years. Hospital stay, six and one-half years. Heredity.

History of Convulsions. — Patient was treated at Bridgewater State Hospital for six months, had three minor attacks during that time. Left June 11, and was seen by a physician June 13, who states he had numerous attacks. Was admitted to Monson State Hospital June 18, 1909, went fifteen months with only one spell, in spite of the fact that during this period he had taken some liquor. During the next sixteen months, with occasional sprees, he had four convulsions. From Aug. 4, 1911, to March 9, 1912, patient was away on a visit. (This was the beginning of his severe and frequent attacks.) Since that time, he has accepted every opportunity for liquor and has never gone more than two months without a convulsion and has had as many as five in one month.

The five cases I have used to illustrate the value of early institutional treatment represent only a small percentage of the cases that are under the care of the State in which alcohol was the exciting cause of the epilepsy. "Rum fits," a term which is so commonly used and often to which so little value is attached, signifies a dormant epilepsy which has been brought out by the use of alcohol, as shown in the cases noted above. The prognosis for those who receive early and proper care is very good, while those cases which fall in Group II. are practically hopeless. The therapeutic test is the only one upon which we can absolutely rely. No case of epilepsy should be considered so hopeless as not to warrant the aid of our best skill and endeavors, while every person who gives a history of convulsions, whether in infancy, childhood or adult life, should be considered potentially epileptic and the prognosis made accordingly.

DILATATION OF THE LATERAL VENTRICLES AS A COMMON BRAIN LESION IN EPILEPSY.*

By D. A. Thom, M.D.,

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Dilatation of the lateral ventricles has always impressed me as being a very common abnormality of the brains in epileptic subjects, and although for a long time it has been well known that convulsions were frequently associated with internal hydrocephalus, especially in those early cases where the dilatation began before cranial synostosis had been completed, I have failed to find ventricular enlargement mentioned in the literature as a common finding in the pathology of epilepsy.

Until recently I have had to content myself with the impressionistic idea relating to dilated ventricles, as many of the brains removed at the Monson State Hospital were preserved entire for photographic work and numerous brains have been sent to the neuropathological department of the Harvard Medical School for total brain sections and intensive study. Therefore, it has been necessary to wait until a sufficient number of consecutive autopsies have been performed before beginning this study.

Since January, 1913, I have collected from my autopsy material the brains of 75 epileptic subjects, the results of 82 consecutive post-mortem examinations, and it is upon a personal analysis of this material that the statistics here presented are founded.

Fifty-seven, or 76 per cent., of this group presented gross brain lesions. This is 13 per cent. higher than was reported in a previous paper ("No. 1, An Anatomical Search for Idiopathic Epilepsy"), but this higher percentage of grossly abnormal brains may be accounted for by more thorough dissection in the search for dilated ventricles. Thirty-one of these 57 cases presented cortical lesions as well as dilated ventricles; 16 showed lesions of the cortex alone, while the remaining 14, with a normal looking cortex, had dilated lateral ventricles.

Of the entire 43 cases revealing cortical lesions, the hind portion of the brain was by far the most frequently affected, especially the occipital lobes. The convolutional shrinkage in this region was often marked, and the appearance was that of an acquired condition rather than one of congenital origin. Next in order of frequency was the general cerebral gliosis, where the entire cerebrum appeared to be involved. Softenings were noted only six times, once being general, the other five times being focalized. ("No. 1, An Anatomical Search for Idiopathic Epilepsy." Thom and Southard, Review of Neurology and Psychiatry, October, 1915.) The rarity of soft brains was rather surprising when one considers that there were 29 cases of well-defined sclerosis of the basilar and cerebral vessels; also, one would expect to find cerebral hemorrhage frequent with these weakened vessels and high blood pressure, but in only two of the 75 cases was there evidence of arterial rupture. Gliosis and atrophy of one hemisphere alone was noted in 8 cases, equally divided between the two hemispheres.

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* From the laboratory of the Monson State Hospital.

The dilated ventricle group, comprising a total of 41 cases, or 54.6 per cent., would form the basis for a very interesting study. Twenty-seven of the brains in this group also had abnormalities of the cortex, which for the moment will be given preference over the dilated ventricles, as being the more likely pathological lesion of which the convulsions are symptomatic. The residue of 14 cases with dilated ventricles, where the cortex of the brain was not grossly abnormal but where the ventricular dilation was of such a degree as to leave no doubt of its abnormality, raises the question as to whether lesions affecting primarily the white matter may not be a factor in the production of epilepsy.

Perhaps there is no field in neuropathology which is so rich in gross pathological brain changes as that of epilepsy. Like the manifestations of the disease itself, the lesions are often of a spectacular character, yet it is most difficult to state whether these lesions are the cause or effect of the convulsions, or whether they are in any way correlatable with the epilepsy.

I hope to be able in the near future to make some attempt at separating the "problematical cause lesions" from those that have been produced directly and indirectly by the disease itself, and then set aside a third group of lesions which, to my mind, are not related to the epilepsy in any way. This will necessitate a careful study of the case histories and intensive microscopical research.

The tables presented below show the age at onset of the convulsions in two groups of dilated ventricle cases, the first, Table A, the 27 cases with dilated ventricles and cortical lesions; the other, Table B, the 14 cases with dilated ventricles without cortical lesions.

TABLE A.—*Age of Onset, First Convulsion.*

Congenital cases,	2
Between 1 and 5 years,	6
Between 5 and 10 years,	3
Between 10 and 20 years,	6
Between 20 and 30 years,	2
Between 30 and 40 years,	1
Between 40 and 50 years,	5
Between 50 and 60 years,	1
Over 60 years,	–
Unknown,	1
	27

TABLE B.—*Age of Onset, First Convulsion.*

Congenital cases,	1
Between 1 and 5 years,	2
Between 5 and 10 years,	–
Between 10 and 20 years,	3
Between 20 and 30 years,	–
Between 30 and 40 years,	2
Between 40 and 50 years,	3
Between 50 and 60 years,	2
Over 60 years,	1
	14

No doubt there would be something gained from an intensive study of these two groups of cases. The congenital and acquired lesions might be separated with some degree of accuracy, and more important yet is the character and location of lesions capable of producing convulsions as compared with those pathological changes produced by convulsions. I am not as yet willing to accept the theory of Gowers, who believes that "Lesions of the cortex alone are capable of producing convulsions." Lesions of the cortex, associated with congenital internal hydrocephalus, no doubt are often secondary, while many of the cases of ventricular distention are acquired rather than congenital defects, and cannot be attributed as the causative factor in the production of convulsions.

Of the 27 cases which belong to the group having both dilated ventricles and cortical lesions it will be noted that 17, or 63 per cent., had their onset before twenty years of age, as compared with 6 cases, or 43 per cent., of Table B, where there were no cortical lesions.

Excluding the alcoholic and syphilitic cases, the onset of convulsions after thirty years of age is not common. Here we find that 57 per cent. of the cases with epilepsy and dilated ventricles (no other gross lesion being present) have their onset after thirty years of age; there is just a suggestion here that if lesions other than those of the cortex are capable of producing convulsions, the nature of the pathological process is slow and the onset of the convulsions late.

Further speculation without intensive study would be fruitless. In closing, I would call attention to the frequency of ventricular dilatation in this series of epileptic brains, — that in 14 of these cases there was no other gross lesion present, although 76 per cent. of the entire group presented some gross lesion at autopsy. These lesions do not in all cases represent the cause of the epilepsy, and by further study they might be placed in one of three groups: —

1. Those lesions to which the epilepsy might reasonably be attributed.
2. Those lesions which might reasonably be explained by the epilepsy.
3. Those lesions which are neither the cause nor results of epilepsy.

IMPACTED WISDOM TEETH AS A CAUSE OF EPILEPSY.

By J. F. Roche, M.D., Palmer, Mass.

At no time in the history of dentistry has the search for the remote causes of disease been more active than at the present, and, as a result of investigations, many of the pathological problems grow brighter.

Observers have noted that impacted or less frequently appearing unerupted teeth, which apparently may be lying dormant in the human jaws, are to be reckoned with, not only as a direct association of cause and effect, but also as an etiological factor in many of the nervous disturbances and other ills which affect mankind.

Probably the best theory of the etiology of the impacted lower third molars is given by Tomes. He says: "The third molars being the last to take their place in the series are, from obstacles opposed to their eruption, a frequent cause of suffering."

The second molar immediately in front and the terminal joint of the alveolar line behind bound the space accorded to the third molar. Each tooth which has no deciduous predecessor is developed beneath the base of the coronoid process in the first instance, and, as the coronoid process recedes by absorption on its anterior and deposition on its posterior surface, the tooth is enabled to come into its proper position; but, if the backward development of the maxilla has been arrested, the interval will be insufficient for the normal arrangements of the presenting tooth.

While the lower third molar and upper and lower cuspids are the teeth most commonly inclined to impaction, any tooth in the arch may become impacted if the surroundings are not such that normal eruption can be made possible. A most serious condition may arise from an impacted lower third molar by pressure being exerted upon the inferior dental nerve. The root development of the teeth may cause infringement of the root upon the inferior dental canal. When this condition is present, the pain is as likely to be manifest in some other part of the head as it is to be in the region of the offending tooth.

Impacted lower third molars are probably the source of more conditions of referred or reflected pain than is manifested by any other organ of the mouth or jaws.

The late Dr. Henry S. Upson, in his book on insomnia and nerve strain, ascribes the cause of many of the nervous disorders, such as insomnia, melancholy, epilepsy, etc., to impacted teeth, and in co-operation with Dr. John Stephen of Cleveland has reported a number of cases as much benefited after their removal. Pains may be from the beginning to the end quite lacking where impacted teeth are located, but it is the constant, though mild, irritation which may set up some of these nervous disturbances, and of themselves take on a violent form.

Cases are reported by Dr. Lyons of Ann Arbor where there has been no return of epilepsy after a period of eighteen months following the removal of the impacted third molars. Dr. Lyons further says: "Whether the impacted teeth were the whole etiological factors in these epileptic conditions or only secondary it is difficult to state." In only one case, however, was it necessary to follow up with the bromides, the attending physician giving credit for the immunity from the nervous disturbance to the removal of the impacted teeth. It can be shown that patients have recovered from obsessions from melancholia and from incipient dementia by relief of lesion of impacted third molars as well as lesions confined to cuspid regions, and by relief of lesions distributed more widely through the jaw.

Absence of pain is no proof a lesion is harmless.

In handling these problems, it is essential that we have a full and comprehensive grasp of two facts, namely: (1) that pain is a symptom and not a lesion; (2) that dental irregularity in the form of impaction is a lesion and not a symptom. Upson says: "The doctrine of the harmlessness of lesions is losing ground rapidly." Dental irregularity may be harmless, but when a tooth is driven head on against the peridental membrane of a neighboring tooth richly nurtured, dental irregularity takes a new aspect, becoming a lesion and is to be reckoned with accordingly. As a striking example of these uncalled for radical operations where the source of irritation was not recognized by the physician or dentist, a history of a case I have recently operated upon will not be out of place.

The patient in question is a young man, twenty years of age, who never suffered an attack of epilepsy until he was seventeen. About three years ago, he met with an accident which produced unconsciousness for a long period. Upon gaining normal health, these epileptic attacks became quite frequent. After admission to this institution, an X-ray was taken to ascertain the location of a possible fracture of the skull. No abnormality of this nature was found, but it showed very clearly the presence of two impacted lower third molars laying with the cusps pressing hard against the roots of the second molars. Using local anæsthetics, I extracted the teeth intact. During January he had four attacks, and in February, up to and including the time after extractions, he had thirteen. He was permitted to return home early in March and up to April 12 enjoyed the absence of attacks with one exception, at which time it lasted less than one minute. The young man is now working every day at his trade.

In conclusion, permit me to assert it is an opinion shared by dentists that all cases of epilepsy cannot be benefited by the removal of impacted teeth, but it should tend to have all dentists ever on the alert in noting symptoms indicative of these conditions, so that he may make accurate and positive diagnosis. In doing so, he will be in a position to treat his patients in a more intelligent and successful manner and thus encourage and promote desirable professional relations with medical practitioners.

I dare say I will have many cases to report as time goes on, for, with the introduction of an X-ray machine for head work at this institution, much will be accomplished which has hitherto passed my notice as operating dentist at the hospital.

Material for this paper has been procured from authorities such as Drs. Lyons, Tomes, Stephen and the late Dr. Upson.

A STUDY OF THE NATIONALITY, EDUCATION, OCCUPATION, RELIGION AND CIVIL CONDITION OF 1,000 EPILEPTIC PATIENTS AT MONSON STATE HOSPITAL.

By Helen Taft Cleaves, M.D.

The entire number of patients admitted to this institution since it was opened about twenty years ago is 3,230. From this number I have selected 1,000 cases, 500 men and 500 women. The records have been taken at random from the shelves, using some from each pile, as they stood in alphabetical order. It seems to me that this method gives a fair basis from which to draw conclusions as to the whole patient population of the hospital.

Nationality.

We will first consider the question of nationality. This question always comes up for a certain share of attention whenever heredity is considered as an etiological factor in pathological conditions. We are prone to think that the race to which the other person belongs is to a larger degree responsible than is our own for the defective germ plasm and other underlying causes which result in incompetency, poverty, feeble-mindedness, insanity, epilepsy, etc. All races, however, have these classes, — the recidivists, — and every civilized country has similar problems, that of providing for these unfortunates, and of preventing, as far as possible, their increase.

The population of our own country is so made up of people from all races and all parts of the world, and for several years our immigrants have come so largely from the dregs of foreign countries, that I began this study confident that I should find at least 50 per cent. of our epileptics foreign-born, or of foreign parentage. I find, however, that notwithstanding my preconceived belief in the superiority of my own race, that 40.7 per cent. of our epileptics are from American stock. I have considered the term "American" to apply to those who were born in this country of parents who were likewise born here. Besides those who, according to this classification, rank as straight American stock, there is a large per cent. of mixed American with other races, European or Canadian.

Of these, the largest per cent., 4.2 per cent., comes from mixed American and Irish races. From a mixture of American and Canadians, we have 3.8 per cent.; from American and English, 1.4 per cent.; from American with other European races, — German, Italian, Dutch, Swedish, Austrian, Russian and Portuguese, — a few each, making 4.5 per cent. more.

In all there are 13.9 per cent. whose parents are one of American, one of European race or Canadian, the latter being, of course, of English, Irish or Scotch descent. That gives more than half, 54 per cent. who are American, or of American plus European extraction. The remainder, 46 per cent., came to our shores as immigrants from European countries, or across the lines from Canada. Some of them, especially the older ones, developed epilepsy in their own country, and emigrated hither before the days of the enforcement of the deportation act; others became epileptic after taking up their residence in America.

We might expect, from its nearness to our borders, that the largest per cent. of the foreign-born would be Canadians, but Canada stands second in this respect, Ireland leading the list with 14.3 per cent. Canada is a little behind, standing at 13.9 per cent. Other European countries follow in this order: England, 5 per cent.; Scotland, 2 per cent.; Germany, France, Portugal, Poland, Italy, Norway, Sweden and Switzerland, a few from each, making 8.8 per cent. from other European countries. From the African race we also get 1.4 per cent.

We have as yet in this institution no Chinese, Japanese or Mexicans, nor any full-blooded Indians; two of our negro patients, however, have a mixture of Indian and negro blood.

Education.

The number of illiterate, dependent and feeble-minded is large, as would be expected by any who are familiar with the mental deterioration caused by epilepsy. Over half, 59 per cent., developed epilepsy before the age of twelve. This means, mental enfeeblement, to a greater or less degree, for all of that number; idiocy, usually, where the onset occurred before the third year of life; more or less stunted development, varying from idiocy to moron type, where it occurred between three and twelve years. There are 28 per cent., or more than one-fourth of this entire group, who are incapable of any education, many being incapable of speech even; 26 per cent. can read and write only, the reading being confined to the simplest words, the writing being often little more than the ability to sign the name. Adding this gives 54 per cent., who are practically illiterate. Of the remainder, 42 per cent. have a common school education. I have put under this heading all those who have attended school beyond the fourth grade, which is a very liberal interpretation of the term, you will concede, putting, however, those who have attended high school in another list. Of these there are 3 per cent., about half the number having been graduated. Four in the 1,000 patients have attended college, taking work toward an A.B. degree, two having obtained that degree, Four others have attended business college.

OCCUPATION.

With 28 per cent. incapable of any education whatever, of speech even in nearly every case, and another 26 per cent. able only to read a few simple words, with just enough skill in writing to enable them to sign their names, we would expect to find a correspondence in the line of occupation, and the statistics show that there are only 39.2 per cent. who have had any occupation by which they could support themselves or contribute to their support. Of the remaining number, 50.8 per cent. have no occupation, and 20 per cent. are unknown, — never have been able to do the work of even a common laborer, or of a housekeeper.

Of the men who have had a gainful occupation, 50 in 1,000, or 5 per cent., of the whole group, are classed as laborers, 14, or 1.4 per cent., have worked at carpentry, 34, or 3.4 per cent., have been employed as clerks, 16 as machinists, 20 as shoemakers, 6 each as printers, painters, salesmen, 5 each as teamsters and farmers, 2 each as plumbers, gardeners, blacksmiths, electricians, sailors, porters, engineers, in United States Navy, keepers of livery stables, watchmen.

Taking the women under consideration, we find that 102 in the 1,000, or 10.2 per cent., have been employed as domestics, either at home or elsewhere, and 39 have been housewives, caring for their own homes and families. There are 4 each who have been employed as waitresses and seamstresses, 2 each as chambermaids and teachers. There have been also 55 employed as mill operatives; this number includes both men and women, however, about equal number of each sex.

Besides those mentioned, there is a sprinkling of a few other occupations, which furnished employment for one individual each, which I will not trouble to mention.

Not many of these occupations, you will notice, call for highly skilled labor. There are, of course, epileptics in the professions; some of them are conducting business successfully, others occupy positions of great responsibility. But the number is small, and these do not dement rapidly, and such cases seldom come to institutional care.

RELIGION.

The religion of an epileptic has nothing to do with the development of his disease, but it is a matter of interest to notice the balance between the two great forms of faith, — the Protestant and the Roman Catholic, — even though the people considered have no vote to cast.

I find that they are pretty nearly equally divided; the Protestants forming 49.9 per cent. and the Roman Catholic, 41 per cent. We have a representation from the Jewish faith, forming 2.1 per cent. The remainder, 7 per cent., is unknown.

CIVIL CONDITION.

Thom has found that in only about 2 per cent. of the marriages of epileptics has there been epilepsy in the offspring. Many of our patients who have been married have found the sea of matrimony a stormy one for themselves, and have gone through separation, desertion or divorce, because of the unhappiness resulting from the misfortune of being an epileptic. So that, even if we could disregard the possibility of transmitting to the offspring the taint of epilepsy, — and we cannot do it, — the marriage of an epileptic should be strenuously discouraged, and prevented if possible.

The number of marriages in the group under consideration is fortunately small, being 14.2 per cent. The preponderance of the unmarried is partly accounted for by the fact that 45 per cent. were too young for marriage when they came to this hospital, considering eighteen years as the youngest marriageable age.

As many in this group were idiots or imbeciles, they were further unfit for marriage. Of the 1,000 patients considered, 59 per cent. developed epilepsy before the age of twelve; 11 per cent. developed epilepsy between twelve and nineteen. This accounts for the large group of idiots and imbeciles.

Of the 30 per cent. who had reached marriageable age before the onset of epilepsy, many were primarily feeble-minded, epilepsy being grafted on this condition of mental enfeeblement. This is another factor which has acted to prohibit marriage.

Subtracting the 45 per cent., which represents the group too young for marriage when admitted, from the whole, leaves 55 per cent. who were of marriageable age; and 14.2 per cent. marriages, considered on this basis, gives 25.6 per cent. of mating among epileptics of a marriageable age. From this mating of 142 epileptics with non-epileptics has come 272 children, an average of not quite two to each marriage. As a matter of fact, however, nearly half, 40 per cent., of the marriages were barren, the general average being brought up by several large families.

SUMMARY.

1. *Nationality.* — Of the epileptics who are under institutional care in Monson State Hospital, 40.7 per cent. are of American parentage, using the word "American" to indicate those born in America of parents who were likewise of American birth. There are 13.3 per cent. who are of mixed American and European parentage, and 46 per cent. are of foreign parentage.

2. *Religion.* — Protestants, 53.9 per cent.; Roman Catholics, 44 per cent.; Jews, 2.1 per cent.

3. *Education.* — There are 28 per cent. who are illiterate and incapable of learning; 26 per cent. read and write only; 42 per cent. have had a common school education; 3.2 per cent. have attended high school; .4 per cent. have attended college; .4 per cent. have attended business college.

4. *Occupation.* — One half, or 50 per cent., of the entire number have never been self-supporting; and but few of those who have supported themselves have done work calling for a high degree of skill or ability.

5. *Civil Condition.* — There are 58.8 per cent. who have never been married; of the 14 per cent. who have married, 40 per cent. of the marriages were barren, the remaining 60 per cent. averaging two children to each mating. In a large per cent. of the cases, marriage was impossible, or we might say that its absence was due because of the early onset of epilepsy, with accompanying mental enfeeblement, and also to amentia which in some cases preceded the epilepsy.

THE INCIDENCE OF INTESTINAL ADHESIONS AS A FACTOR IN CHRONIC INTESTINAL STASIS IN THE EPILEPSIES.*

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The trend of recent epileptologic research has been directed in large part toward the gastro-intestinal tract and the glands of internal secretion. It has been away from the brain structures and the postulates built about them, and once more toward the factors of intestinal irritation and intoxication. The presence of constipation among epileptics has been noted so frequently that again the tendency has been to account for the seizures as due to the absorption of toxic products from the chronic intestinal stasis that may be present.

The exact cause of the chronic intestinal stasis is still much in doubt. Up to the present time the investigations may be divided into two groups, namely, those which declare it due to faulty metabolism of the endocrine system, and those which account for the chronic intestinal stasis by the abnormalities of the intestinal tract that have been found to be present. Under the first group, the over-functionating of the adrenals has been presented as a causal factor. At least one type of epilepsy may be a disease process dependent upon the absorption of irritating substances from the intestinal tract, the inhibition of the smooth muscle fibers of the intestines being due to over-action of the adrenals, because of dysfunction of the pituitary gland or of the pancreas, or because of irritation of the duodenum. This conclusion is based upon animal experimentation and Abderhalden tests for adrenalin.[1] While this view has much in its favor, yet the fact that recent investigation has shown that the Abderhalden test, as an index of disease or disorder of function of any particular gland, is not dependable, militates against its immediate acceptance.[2]

The second group of investigators believe that because of mechanical interference, the fecal current is obstructed, and chronic intestinal stasis with absorption of toxic products occurs.[3] This interference may be caused by some form of visceroptosis, by a large, flabby, mobile cecum, by retardative angulations at the hepatic or splenic flexures, by redundant sigmoid, by adhesions of both the ileum and the colon, or by exudative periduodenitis and the like. The nature of the toxic products has not been definitely discussed. It has been advocated that the product is a toxin formed by a bacillus,[4] but this hypothesis has not been confirmed.[5] These views depend for their substantiation upon Roentgen-ray examinations of the intestinal tract and upon findings at operation.

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* Read before the New England Society of Psychiatry, March 27, 1917.

It was with this latter concept in mind that a review of necropsy records among institutional epileptics, for the purpose of ascertaining the relative frequency of such mechanical causes, was undertaken. But to correlate the presence of visceroptoses, angulations and the like, from necropsy reports, is always open to the criticism that post-mortem changes may account for the lesions found. Accordingly, this investigation was limited merely to the presence of fibrous bands and adhesions, and their relation to the condition under discussion. While it may be said that these are the end results of constipation, or better, chronic intestinal stasis, yet it cannot be denied that their existence would prove that this condition in some degree was present.

A total of 250 post-mortem examinations was studied. In 212 no mention was made of chronic focal peritonitis, adhesions, or congenital abnormalities. For the purpose of this paper, these will be considered as essentially negative. Twenty-six cases among this number had cholelithiasis, accompanied in 10 by chronic cholecystitis, but without evidence of local peritonitis. Of the 26, only 2 died before the age of thirty, and over 80 per cent. occurred in those dying after the age of forty. In only one case was there a distinct etiologic factor present, namely, enteric fever. Hence the causal factor must be considered to be chronic intestinal stasis, which, by leading to an accumulation of feces in the hepatic flexure, interferes with the flow of bile through the cystic duct and thus produces stagnation in the gall bladder and the tendency to form concretions. In passing, it may be of interest to note that the incidence of cholelithiasis in this series was 12.5 per cent. This is somewhat higher than the incidence found in general hospitals (5 per cent. at St. George's Hospital, London; 9.4 per cent. by Naunyn; 6.9 per cent. by Mosher).[6]

Of the remaining 38 cases, there were 15 with chronic perityphlitis, varying from a single band to complete binding down of the appendix. Two of these cases were complicated by cholelithiasis. Chronic appendicitis is usually thought of as one of the factors to be considered in the causation of constipation. But Satterlee states that in a series of 136 cases suffering from chronic intestinal stasis, 25 per cent. had the appendix removed, but were not relieved by the procedure. There was a speedy relapse to the former condition.[7]

The following 8 cases were examples of the results of pericolonic exudations, resulting from chronic intestinal stasis. Firm bands binding down the cecum were found in one case, not complicated by chronic appendicitis. Adhesions in the vicinity of the splenic flexure were found in 5 cases, 3 of these involving the spleen also. The descending colon and part of the transverse colon were found to be firmly bound down by fine adhesions in 2 cases.

Eight cases showed adhesions between the coils of the small intestine, probably the end-result of tubercular peritonitis. Their character could readily cause ileal stasis. Unfortunately the data at my disposal were not sufficient to determine the relationship between the onset of the seizures and the abdominal condition.

There remain 6 cases where there were adhesions involving the gall bladder, duodenum and transverse colon. Two were complicated by cholecystitis and cholelithiasis, and the adhesions present were probably the result of a local peritonitis following the gall-bladder infection. The remaining 4 cases were not complicated by gall-bladder disease, or by gastric or duodenal ulcer. In these, there were found fine, web-like adhesions extending from the gall bladder to the hepatic flexure and involving the pylorus and first part of the duodenum. They may be classified as congenital transduodenal bands. Harris[8] believes that these bands are the remnants of the anterior mesentery of the upper gut. Persisting after the rotation of the stomach and duodenum has occurred during fetal life, they remain stretched across the duodenum and pylorus, extending from the inferior surface of the liver to the hepatic flexure. These bands may cause interference with the flow of the fecal current, resulting eventually in chronic intestinal stasis. They are precursors of, rather than the result of, the condition under discussion.

The last case of this series was one of umbilical hernia with adhesions to the small intestine. This lesion, however, definitely occurred many years after the onset of the epileptic seizures, and need not be considered further.

SUMMARY.

Intestinal adhesions and bands of varying degrees and etiology were described in 38 cases in this series. These divide themselves into two groups: (A) those that may be considered to be a factor in the causation of chronic intestinal stasis; and (B) those that may be considered to be the result of this condition.

TABLE I.

Adhesions causing chronic intestinal stasis,		12
Congenital transduodenal bands,	4	
Inter-intestinal adhesions probably due to tubercular peritonitis,	8	
Adhesions resulting from chronic intestinal stasis,		25
Chronic perityphlitis,	15	
Pericolonic exudations,	8	
Due to gall-bladder disease,	8	
Adhesions due to hernia,		1
		38
Necropsies considered as negative,		212
		250

In Group A, the 4 cases of transduodenal bands must be placed, for being congenital, they antedate the onset of the epileptic seizures, and from their position could easily be a strong factor in producing chronic intestinal stasis. If the conclusion that the 8 cases of adhesions between the small intestines were the end-results of healed tubercular peritonitis is correct, then these may be considered under this heading, for from their very nature they would cause intestinal stasis of varying degrees.

The remaining 25 cases (the case of umbilical hernia being excluded) must be placed under Group B. The adhesions about the appendix may be the result of pericolonic exudations due to chronic intestinal stasis, as well as the result of a more acute process. Adhesions involving the remaining portions of the large intestine readily come under this heading.

In conclusion, it is evident that intestinal adhesions and bands play a rather small part in the causation of chronic intestinal stasis in the epilepsies. Excluding those lesions due to previous acute abdominal infection (*i.e.*, tuberculosis), as well as those due to pericolonic exudations resulting from the stasis present, there are left but 4 cases (*i.e.*, congenital transduodenal bands) in a series of 250 necropsies where the clinical symptom may be said to be the result of the lesion found at autopsy.

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INTESTINAL ADHESIONS AND PERITONEAL BANDS IN EPILEPTICS.*

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So much emphasis has been placed upon the abnormalities of the gastrointestinal tract, and the relation of the superimposed condition of chronic intestinal stasis to the convulsive seizures, that at times it has almost appeared necessary to assume that every constipated individual was a potential epileptic. But the fact remains that most constipated individuals are not. There is, without doubt, one type of epilepsy where a definite relationship between intestinal conditions and the seizures does exist, but it includes only a small percentage of those suffering from this group of diseases. The purpose of this paper is, first, a consideration of the causes of chronic intestinal stasis; second, the etiologic factors present in the causation of intestinal adhesions and abnormal peritoneal bands; and, third, inasmuch as these bands and adhesions give some evidence of the presence of colonic stasis, a comparison of the incidence of this pathologic condition as found in the necropsy protocols of an institution for epileptics and in those of a general hospital.

The abnormalities of the intestinal tract may manifest themselves clinically by varying degrees of chronic intestinal stasis. It is possible that derangements of the metabolism of the endocrine glands may play a part in the causation of this condition in those epileptics in whom intestinal stasis is a prominent symptom.[1] But the more usual causes of chronic intestinal stasis are frequently found present in epileptics. The sedentary conditions under which, of necessity, many of those suffering from this group of diseases must live, combined with general mental apathy, due to the disease itself or to bromism, may produce the condition in some. Restricted diets, lessened water intake, gluttony, lack of habit formation, flabby abdominal musculature, and overpowering inhibitory influences surely play their part.

Increasing resistance to the passage of the fecal current may be due to enteroptoses, angulations, fibrous bands and adhesions, strictures of the lumen of the gut, movable cecum, and the like.

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* Read before the National Association for the Study of Epilepsy, May 29, 1917.

But while developmental and congenital anomalies are at the bottom of many cases of constipation,[2] yet Roentgen-ray examinations have shown that such mechanical obstacles do not, necessarily, entail a condition of stasis. Indeed, passage through the large intestine may occur quite normally in spite of them.[3] With the possible exception of colonic atony or colonic tetany due to disturbances of innervation of the intestines, the chronic intestinal stasis of epileptics depends upon the same causative factors as found in every constipated individual.

Intestinal bands and adhesions have been selected for this study, for the reason that they are not affected by post-mortem changes, and, in consequence, assuming that the error of omission is a constant, the conclusions drawn from their incidence are less open to criticism. There are three important factors in the causation of intestinal bands and adhesions, namely, (1) defects in embryonic development, (2) acute inflammations of the peritoneal surfaces, and (3) mechanical causes.

Congenital anomalies are by no means frequent. Under this heading may be mentioned the peritoneal bands and web-like processes which, arising in the vicinity of the gall bladder, extend across to the pylorus, duodenum, hepatic flexure, and transverse colon. These are probably remnants of the anterior mesentery. I have found such processes in eight necropsies upon epileptics. They may not give rise to symptoms, but Homans, in a clinical study of 11 cases, mentions constipation as being present in two. One of these, at operation, showed a firm band of peritoneum stretching across the hepatic flexure.[4]

The acute inflammatory factors giving rise to adhesions included such conditions as tuberculosis, peritonitis, gall-bladder disease, appendicitis and its complications, inflammations of the female adnexa, and other acute abdominal states. The *modus operandi* of these lesions is well known. In this connection it may be well to suggest that adhesions about the appendix may be due to mechanical causes as well as to acute infections.

The mechanical factors are at work chiefly in the region of the colon, and resulting from stasis serve to accentuate any intestinal abnormality that may be present.[5] It has been suggested that the sequence of events in the formation of pericolonic membranes is first a condition of colonic stasis from any of the causes, or combinations of them, mentioned above. Then colonic dilatation with increasing stasis occurs, until finally bacterial invasion and toxin osmosis into the pericolonic tissues causes the formation of anchoring bands or diffuse membranes. It is of interest that Turck has shown that the intestinal wall is permeable to the intestinal flora, and that histological changes occur in the cells, through which the bacteria may have migrated.[6]

In a recent investigation I came to the conclusion that peritoneal bands and intestinal adhesions played but a small part in the causation of colonic stasis, but stated that their presence was an indication that, in at least some degree, this condition had been present.[7] From the standpoint of pathological material they may well serve as a method of comparing intestinal abnormalities and symptoms among epileptics and normal individuals. It is hardly to be denied that functional tests as shown by Roentgenographic work is a far more desirable index to base conclusions upon, but at present such comparisons are hardly feasible.

I have reviewed the protocols of 280 necropsies on epileptics recorded at the Monson State Hospital from 1900 to the present time. Acute abdominal conditions and adhesions complicated by carcinoma have been omitted from the tabulation. In this series, intestinal adhesions and peritoneal bands were mentioned in 50 necropsies (17.85 per cent.). Peritoneal bands were found originating in the region of the gall bladder and extending across to the hepatic flexure and transverse colon in 8 cases. In 5 only the duodenum and pylorus were involved by such bands. In none of these was there any evidence of gall-bladder disease, gastric or duodenal ulcer. Extensive adhesions due to cholecystitis were found in 2 cases. Adhesions between the coils of the small intestine were present in 8, and in only 1 of these was there any apparent connection with inflammation in the right inguinal region.

Turning to the region of the large intestine, adhesions of varying degrees about the appendix were found in 14 protocols. In 3 more both cecum and appendix were involved. In 2 cases there were firm bands about the cecum alone, 1 being due to an appendectomy. The ascending colon was found to be firmly bound down once, while the descending colon was similarly affected twice. Four protocols described bands causing displacement of the splenic flexure. The last necropsy of this series was complicated by umbilical hernia. The adhesions found present were due to this, but the epilepsy had been definitely established before the appearance of the hernia. It will be noted that in 38 of these protocols, the adhesions and bands mentioned were about the large intestine, especially in the region of the cecum and ascending portion. It is in the large gut that stasis would naturally occur.

Table I. — *Site of Adhesions in 280 Necropsies on Epileptics.*

Gall bladder to duodenum and pylorus,	5
Due to cholecystitis,	2
Small intestines,	7
Small intestines plus cecal adhesions,	1
Appendix,	14
Appendix and cecum,	3
Cecum,	2
Ascending colon,	1
Gall bladder to hepatic flexure and transverse colon,	8
Splenic flexure,	4
Descending colon,	2
Due to hernia,	1
Total,	50

But does the above incidence of adhesions among epileptics differ at all from that of non-epileptics? For this purpose, through the courtesy of Dr. Frank B. Mallory of the Boston City Hospital, I investigated some 775 necropsy protocols contained in the records of the pathological laboratory of that institution for the years 1900–1903 and 1910. Omitting acute abdominal disease, as well as carcinoma, I found mention made of bands and adhesions in 142 protocols (18.3 per cent.).

Turning first to the region of the gall bladder, this viscus was bound down to the duodenum and pylorus in 4 cases. In 23 more, peritoneal bands and adhesions stretched from the inferior surface of the liver across to the transverse colon and hepatic flexure; one of these had, furthermore, firm adhesions about the splenic flexure, while 3 were complicated by gall-bladder disease. In 17 protocols, adhesions between the coils of the small intestines were mentioned, and in only 3 was there definite evidence of inflammation about the appendix, thus indicating an earlier acute peritonitis. Varying degrees of tying down of the appendix were found in 44 cases, while in 15 more the adhesions involved the cecum as well. One of the latter showed an abnormal band of peritoneum stretching across the splenic flexure. The cecum alone was found involved in 9 cases. The ascending colon was firmly tied down in 2. Bands about the hepatic flexure were described in 5, while the splenic flexure was similarly involved in 3. The descending colon was buried in pericolonic membranes in 3 cases, while there were bands and adhesions of varying degree about the sigmoid in 7. Of the remaining protocols, adhesions in 4 were due to hernia, and in 6 to operative procedures within a year preceding time of death. It will be noted here also that the site of predilection for adhesions and bands appears to be in the vicinity of the large intestine. From a total of 142 protocols, over two-thirds showed bands in this region.

TABLE II. — *Site of Adhesions in 775 Necropsies at a General Hospital.*

Gall bladder to duodenum and pylorus,	4
Due to cholecystitis,	3
Small intestines,	14
Small intestines plus appendiceal bands,	3
Appendix,	44
Appendix and cecum,	15
Cecum,	9
Ascending colon,	2
Gall bladder to hepatic flexure and transverse colon,	20
Hepatic flexure,	5
Splenic flexure,	3
Descending colon,	3
Sigmoid,	7
Due to hernia,	4
Operations within a year,	6
Total,	142

To recapitulate briefly, it has been shown that in a review of 775 necropsy protocols of patients in a general hospital the incidence of intestinal adhesions and peritoneal bands was found to be relatively the same as in a series of 280 necropsies upon epileptics. Considering each portion of the intestinal tract separately, it will be noted that this general statement holds true throughout. The favorite site of these adhesions is about the large intestine, thereby favoring the presence of colonic stasis.

CONCLUSIONS.

1. In view of our present knowledge, the constipation of epileptics cannot be said to be due to factors differing far from those usually considered in the colonic stasis of other patients.

2. Intestinal adhesions and peritoneal bands are due to congenital defects, acute inflammatory processes, or mechanical causes.

3. Such processes are no more frequent in epileptics than in non-epileptics.

4. It seems probable that intestinal anomalies are not present in any greater proportion in epileptics than in other persons, and in the last analysis, we are still combating, from a therapeutic viewpoint, a general condition, and no one particular lesion or pathologic phase of metabolism.

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3. Borgbjaerg, A.: Ugeskrift for Laeger, Copenhagen, Vol. LXXIX, No. 5.

4. Homans, J.: *Boston Med. and Surg. Jour.*, Vol. CLXXV, No. 19, p. 665.

5. Jones, G. I.: *Am. Jour. of Med. Sci.*, Vol. CXLIX, No. 3 (516), p. 388.

6. Turck, F. B.: *Boston Med. and Surg. Jour.*, Vol. CLXXVI, No. 19, p. 663.

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A COLLECTION OF EPILEPTIC LITERATURE FOR THE MONSON STATE HOSPITAL.

By Everett Flood, M.D.

Among this collection we have the newspaper clippings and items of current interest which have appeared in the magazines for a great many years. These are catalogued and collected together in uniform covers. The purpose is to continue this collection and to extend it as fully as possible each year.

We have also in mind to write biographical sketches of each of the early contributors to the study of epilepsy. The principal names would be as follows: Sir William R. Gowers, M.D., M. Gonzalez Echeverria, M.D., William P. Spratling, M.D., J. Russell Reynolds, M.D., William Aldren Turner, M.D., Prof. Otto Binswanger, M.D., Dr. A. Ulrich, Brown-Sequard, M.D., M. L. Marchand, M.D., Dr. J. B. Gelineau, Edward Henry Sieveking, M.D., J. L. C. Schroeder Van Der Kolk, M.D., Josef Rosenberg, M.D., John Cooke, M.D., Charles Bland Radcliffe, M.D., George M. Gould, M.D., J. F. Munson, M.D., William P. Letchworth, M.D., David Fairchild Weeks, M.D., L. Pierce Clark, M.D., Matthew Woods, M.D., William T. Shanahan, M.D., Arthur L. Shaw, M.D., William N. Bullard, M.D., Henry H. Goddard, M.D., Alfred Gordon, M.D., William C. Graves, M.D., Thos. J. Mays, M.D., Lewis J. Pollock, M.D., Graham-Brown, Hare, Bourneville and Worcester.

In reference handbooks there have been articles on epilepsy during past years; there is a very good one in Allbutt's System of Medicine, Reference Handbook of Medical Sciences, Ziemssen's Cyclopædia of the Practice of Medicine, Strümpell's Text Book of Medicine and in nearly all the works on psychiatry and neurology. These have been catalogued with reference to their place of publication.

Articles written at Monson State Hospital.

Dr. Everett Flood: —

- Alcove Beds for the Epileptic. 1897.
- Five Cases of Pseudo-Hypertrophic Paralysis in One Family. 1896.
- Intestinal Antisepsis, Diet and Castration in Relation to Epilepsy.
- Manic-depressive Insanity and Epilepsy. 1909.
- Treatment and Results in 150 Cases of Epilepsy in Children. 1896.

Dr. Everett Flood — *concluded.*
- Epilepsy as a Symptom.
- Evolution and Darwinism. 1905.
- Child Study. 1899.
- Emasculation in 26 Cases.
- Epilepsy: General Observations and Home Care.
- Observations: Blood Pressure, etc.
- A Treatment Room for Epileptics.
- Home Care of Epileptic Children.
- The Proportion of Epileptic Persons to the Whole Population in Hampden County and Three Towns in Worcester County.
- A Hospital Composite.
- The Psychology of Epilepsy. 1903.
- Observations — Helpfulness. 1904.
- Diet of Epileptics.
- Observations on Epilepsy.
- The Care of Epileptics. 1912.
- A Study of Heredity in Epilepsy. 1913.
- Epilepsy as an Inheritance and Other Factors. 1912.
- The Truth about Calomel.
- Results noted from the Care and Observation of nearly 1,500 Cases of Epilepsy at the Massachusetts Hospital for Epileptics, during a Period of Nine Years.

Dr. M. B. Hodskins: —
- Accidents to Epileptics and how they may occur.
- Diet in Epilepsy.
- Exhaustion Paralysis in Epilepsy. 1904.
- Myoclonus Epilepsy.
- Organic Epilepsy. 1905.
- Salt Poor Diet. 1903.
- The Inheritance of Epilepsy. 1912.
- The Relation of Eye Strain to Epilepsy.

Dr. D. A. Thom: —
- Crotalin and its Value in the Treatment of Epilepsy.
- An Anatomical Search for Idiopathic Epilepsy. (Dr. Thom and Dr. Southard.) 1915.
- A Possible Parathyroid Element in Epilepsy (Abstracted from Practical Harmone Therapy) for the Epileptic Library.
- Coagulation Time of the Blood in Epileptics. 1914.
- The Value of Sulphur as a Laxative.
- The Present Status of Crotalin in the Treatment of Epilepsy. 1914.
- The Relation between the Genetic Factors and the Age of Onset in 157 Cases of Hereditary Epilepsy. 1915.
- The Frequency of Epilepsy in the Offspring of Epileptics. 1915.

Dr. R. A. Greene: —
- Treatment of Ordinary Conditions of Epilepsy.
- Report of the Treatment of 10 Cases of Epilepsy at the Massachusetts Hospital for Epileptics. 1904.
- Report of Two Months' Use of Luminal (Phenylethylmalonylurea) in 14 Cases of Epilepsy.

Dr. Geo. E. King: —
- Functional Activity of the Kidneys in Epilepsy.

Dr. E. A. Kennedy: —
- Heart Lesions in Epileptics.
- Blood Pressure Observations in Epilepsy.
- Genealogical Trees of Epileptic Families. 1910.
- Relation of the Monthly Uterine Colic to Epilepsy. 1910.

Dr. A. V. Cooper: —
- Heredity in Epilepsy. 1906.
- Genealogical Trees of Epileptic Families. 1910.
- A Chronic Case of Epilepsy with Apparent Recovery, following an Operation for Vasectomy.

Dr. E. S. Douglas: —
- A Case in which a Series of Jacksonian Petit Mal and Grand Mal Attacks preceded Status Epilepticus. 1911.

Dr. F. W. Guild: —
- The Significance of the Onset of Convulsions to the Epileptic Genealogical Trees of Epileptic Families. 1910.

Dr. Arthur O. Morton: —
- Advantages of Epileptic Persons being treated at a Considerable Distance from their Homes.
- Reflexes in Epilepsy. 1904.
- Report on the Hypochlorization Method of Treatment of Epilepsy. 1904.
- Treatment of Status Epilepticus. 1903.
- Epilepsy. 1901.
- Report of the Treatment of 10 Cases of Epilepsy at the Massachusetts Hospital for Epileptics. 1904.

Dr. L. B. Alford: —
- Brown-Sequard's Epilepsy in Guinea Pigs. 1911.
- Organic and Idiopathic Epilepsy, A Study. 1911.
- A Case of Glioma of the Frontal Lobe.

Dr. A. E. Taft: —
- Lesions of the Major Trunk Viscera in Epileptics.
- Report of a Study of Brown-Sequard's Epilepsy in Guinea Pigs. 1910.
- Epilepsy in Guinea Pigs.

SELECTED STATISTICS CONCERNING EPILEPTICS USED AT THE MONSON STATE HOSPITAL IN ILLUSTRATION OF ITS WORK, 1917.

By Everett Flood, M.D.

MALE PATIENTS		538
FEMALE PATIENTS		492
TOTAL	1,030	
NUMBER OF EMPLOYEES		242
YEARLY COST		$249,825.27
YEARLY COST PER CAPITA		$253.91
VALUE OF PROPERTY		$960,573.56
ACREAGE		660.79
NUMBER BUILDINGS		60
NUMBER OF QUARTS MILK PRODUCED		232,976

RATIO OF EPILEPTICS PER 1,000

Country	Ratio	Author	Year
U. S. A.	2.0	Peterson	1904
FRANCE	2.5	Burlureaux	1890
PRUSSIA	2.9	Binswanger	1895
ITALY	1.15	Morselli	1895
SWITZERLAND	1.5	Kolle	–
RUSSIA	1.0	Shoutelwort	1901
AUSTRALIA	0.4	Victorian year book	1894

Turner, 1907

ONLY 3½% of the EPILEPTICS
in the UNITED STATES
ARE CARED FOR IN INSTITUTIONS
200,000 PEOPLE SUFFER
FROM EPILEPSY
in the
UNITED STATES

ONLY 13 STATES
HAVE COLONIES
FOR THE CARE OF EPILEPTICS
THEY CARE FOR
7,000 PATIENTS

EPILEPSY IN THE OFFSPRING OF CERTAIN EPILEPTICS

Monson State Hospital

MARRIED EPILEPTICS		138
Males	68	
Females	70	
Epilepsy before marriage		47
Epilepsy after marriage		91

Had 553 children

OF THE CHILDREN:—

DIED IN INFANCY OF CONVULSIONS	6
EPILEPTICS	2
ARRESTED CASES	2

OLDER DATA OF ECHEVERRIA

Reported American Journal of Insanity 1880

Married epileptics		136
Males	62	
Females	74	

HAD 533 CHILDREN

	Males	Females	Total
DIED IN INFANCY OF CONVULSIONS	89	106	195
EPILEPTICS	42	36	78
IDIOTS	11	7	18
INSANE	5	6	11

MONSON STATE HOSPITAL

1,000 Cases studied

EDUCATION

1 in every 3
cannot read or write
1 in every 4
can read and write only
340 have common school
or grammar school education
32 have attended high school
4 have attended college

HEMIPLEGIA—FREQUENT IN EPILEPTICS

500 MEN STUDIED
1 in 25 or 4% had Hemiplegia

500 WOMEN STUDIED
1 in 13 or 7.6% had hemiplegia

Of the 1,000 patients
142 only have been married
142 marriages produced 256 offspring

POSTURAL METHODS AND EXERCISES
as suggested by
BRYANT AND GOLDTHWAIT

Number of patients under treatment	20

There are 11 cases at the
Children's Colony
being treated with
EXTRACT OF THE THYROID GLAND
and
PITUITARY BODY

LESIONS

THE MOST FREQUENT ABNORMALITY FOUND AT AUTOPSY AT BOTH CRAIG COLONY AND MONSON STATE HOSPITAL WAS DILATED LATERAL VENTRICLES

ABNORMALITIES IN THE PINEAL GLAND AND PITUITARY BODY HAVE BEEN MET WITH VERY FREQUENTLY IN THE MONSON AUTOPSIES

COAGULATION TIME OF THE BLOOD OF EPILEPTICS

Number of cases examined before — during — and after convulsions .	203	
Number of cases within normal limits	187	92%
Number of cases under minimum limits	11	5.5%
Number of cases over maximum limits	5	2.5%

RAPID COAGULATION OF THE BLOOD WAS THE BASIS OF THE CROTALIN TREATMENT

MENTAL DETERIORATION
IN EPILEPTICS
IS OFTEN IN DIRECT PROPORTION
TO THE FREQUENCY AND SEVERITY
OF THE CONVULSIONS

PROPER FOOD, REGULATED WORK,
and
ROUTINE LIFE
LESSEN THE FREQUENCY
OF THE CONVULSIONS
and
POSTPONE DEMENTIA

NORMAL AND ABNORMAL BRAINS

NORMAL LOOKING BRAINS	39%
AUTOPSIED CASES	205
NORMAL BRAINS, NO GROSS LESIONS	76
ABNORMAL BRAINS, GROSS LESIONS	129
NORMAL	
ACQUIRED DEMENTIA	35
FEEBLEMINDEDNESS	29
WITHOUT MENTAL SYMPTOMS	4
ABNORMAL	
ACQUIRED DEMENTIA	46
FEEBLEMINDEDNESS	69
WITHOUT MENTAL SYMPTOMS	1

90% OF CASES IN BOTH SERIES WERE
EITHER AMENTS OR DEMENTS

DENTAL WORK

EXTRACTIONS	450
FILLINGS	150
CLEANINGS	2,100
BRIDGE AND PLATE WORK	15

NUMBER OF TUBERCULAR PATIENTS

Male		16
Female		33
Total	49	

NUMBER OF PATIENTS WHO WORK

Male		368
Female		476
Total	844	

SCHICK TEST

Applied to 74 children
28 positive
46 negative

OUT OF 1,033
CASES OF EPILEPSY —
TWENTY-FIVE WERE
MENTALLY NORMAL

NUMBER OF EPILEPTICS IN RELATION TO RACE IN MASSACHUSETTS

1,000 Cases studied

AMERICAN STOCK			40.7%
BRITISH STOCK			35.2%
English		5	
Irish		14.3	
Scotch		2.0	
Canadian		13.9	
MIXED AMERICAN AND BRITISH STOCK			9.3%
OTHER EUROPEAN RACES			8.9%
AMERICAN MIXED WITH	German	4.5%	
	Austrian		
	Russian		
	Portuguese		
	Swedish		
NEGRO			1.4%

DISTRIBUTION OF MENTAL LEVELS AT

Children's Colony

NORMAL	4 girls	3 boys
BACKWARD	8 girls	10 boys
MORON	29 girls	3 boys
FEEBLEMINDED	9 girls	6 boys
IMBECILE	21 girls	10 boys
IDIOT	20 girls	30 boys

DAILY PROGRAM

Children's Colony

6.00–7.30 A.M.	Breakfast
7.30–9.30 A.M.	Ward work
9.30–11.00 A.M.	School
	Sewing
	Ground work
11.00–12.00 M.	Dinner
12.00–1.15 P.M.	Recreation
1.15–4.15 P.M.	Classes
4.15–5.15 P.M.	Recreation
5.15–6.00 P.M.	Supper
6.00–8.00 P.M.	Recreation
8.00 P.M.	Bedtime

INDUSTRIAL WORK

Children's Colony

MANUAL TRAINING	6 boys	10 hours a week
CONSTRUCTION WORK	24 boys	6 hours a week
GARDENING	24 boys	variable
EMBROIDERY	18 girls	3 hours a week
CROCHETING	18 girls	3 hours a week
BASKETRY	12 girls	3 hours a week
SEWING	24 girls	9 hours a week
LOOM–WEAVING	8 children	5 hours a week
HOUSEWORK	8 children	variable

SCHEDULE OF CLASSES

Children's Colony

1. Regular Class-room Work

a. Advanced class	45 girls and boys	1.15–3.15 P.M.
b. Primary class	25 girls	9.30–11.00 A.M.
c. Primary class	31 boys	9.15–10.45 A.M. 2.00–3.00 P.M.
d. Kindergarten	12 girls	10.00–11.00 A.M.
e. Kindergarten	8 boys	9.15–10.45 A.M.

2. Music

a. Chorus singing		30 minutes daily
b. Piano practise	14 girls	1 hour daily

3 lessons a week for each girl

OFFENCES BY 26 MALE EPILEPTICS ADMITTED TO BRIDGEWATER STATE FARM

Drunkenness	13
Assault	4
Vagrancy	4
Larceny	2
Disturbing peace	1
*Murder	1
Not criminal	1

* Question if patient is epileptic

CAUSES OF DEATH IN EPILEPTICS

	Craig Colony, New York	Monson Hospital
Epilepsy	38.8%	35.1%
Pneumonia	22.8	12.2
Tuberculosis	13.2	10.2
Cardio-vascular-renal	9.5	15.1
Infections and infectious diseases	6.8	.9
Nervous diseases	3.4	4.8
Gastrointestinal diseases	2.0	4.3
Constitutional diseases	1.5	1.9
Pulmonary edema	–	8.7
Asphyxia	–	3.4
All other causes	–	2.9

2,000 DEATHS ANNUALLY
REPORTED DUE TO EPILEPSY
IN POPULATION OF ADULTS
FIFTEEN YEARS AND OVER
ACCORDING TO THE LAST
UNITED STATES CENSUS

EPILEPSY AND LONGEVITY

THE AVERAGE AGE AT
DEATH AT MONSON STATE
HOSPITAL IN 205 CASES
COMING TO AUTOPSY WITH
NORMAL LOOKING BRAINS
38.9 years

ABNORMAL BRAINS
41.44 years

AT CRAIG COLONY THE
AVERAGE AGE AT DEATH
WAS 30 YEARS IN 271
CASES

FREQUENCY OF GROSS BRAIN LESIONS

THE CRAIG COLONY HAS
RECORDS OF OVER 600
AUTOPSIES ON THE BRAINS
OF EPILEPTICS; 60%
SHOW GROSS BRAIN LESIONS

SIMILAR STUDY AT THE
MONSON STATE HOSPITAL
SHOWED 129 CASES WITH
GROSS BRAIN LESIONS
OUT OF 205 CASES OR 61.5%

SYPHILIS

AT CRAIG COLONY FOR EPILEPTICS 2.48% OF 886 WASSERMANN TESTS WERE POSITIVE

AT MONSON STATE HOSPITAL 3.73% OF 535 WASSERMANN TESTS WERE POSITIVE

FEMALE	(250)	15 or 6%
MALE	(285)	5 or 1.7%

VARIOUS INVESTIGATIONS OF CROTALIN

	Cases treated	Improved	No Change	Worse	Died	
MASSACHUSETTS	14	1	4	8	1	Improved case; typical hystero epilepsy.
MICHIGAN	22	5	8	7	–	One case became insane; sent to asylum.
PENNSYLVANIA	16	–	8	5	2	One case developed intolerant toxic symptoms.
VIRGINIA	6	–	6	–	–	Termed as a "perfect fake."
Totals	58	6 10%	26	20 35%	3	Deaths not attributed to use of drug.
KANSAS	Several					Cannot see we have obtained any benefit.
NEW YORK	Several					Without any apparent result.
OHIO	Have made quite extensive tests					"Find it to be practically a flat failure."
TEXAS	400 for a period of one year.					No curative effect on epilepsy; physiological effect, however, good.
MISSOURI and NEW JERSEY						Were not willing to subject patients to treatment without more definite hope.

FREQUENCY OF GENETIC FACTORS

	Alone	With Other Taints	Total	Direct Heredity	Collateral	Total
EPILEPSY	44	44	88 57%	49	39	88
ALCOHOL	23	36	59 38%	58	1	59
INSANITY	17	26	43 27%	24	19	43
FEEBLEMINDEDNESS	3	13	16 10%	13	3	16
MIGRAINE	9	27	36 23%	34	2	36

ADMINISTRATION.

SEMIANNUAL CONFERENCES.

The second semiannual conference of the Massachusetts Commission on Mental Diseases and the trustees and superintendents of the different institutions was held at the State House on May 28, 1917. The subject for discussion was: —

The Functions and Duties of Trustees.

The views of the speakers were as follows: —

Mr. Donald Gordon, trustee, Worcester State Hospital: — A prominent family of this vicinity has been described as having "well-defined customs but no manners." Paraphrasing this description, the trustees of our State institutions may be said to have well-defined duties but no powers. Under the present law about all they can do of their own motion, and without consultation or approval, is to send in an annual report to the Governor; and then if the Governor does not like what they say, all he has to do is to wave his hand and the State Commission steps in and runs the institution. If you don't believe it, read the General Acts of 1916, chapter 285, section 3.

In view of this situation it is not to be wondered at that the question is often asked, "What is the use of having trustees at all?" Sometimes the public asks the question, but more frequently it comes from the trustees themselves. These trustees are, generally speaking, a pretty respectable and fairly able set of people, who give up a good deal of valuable time, a considerable part of which they feel is wasted. Are they right in this feeling? And if so, can anything be done about it?

As to the first question, I personally feel that a good deal of the average trustee's time is wasted. I come away from some of our meetings with an abiding conviction that we have fiddled around and gone through the motions and tried to be of some use, but that the glory of God and the welfare of the insane in this Commonwealth would have been as well served if we had invited our superintendent and all gone to the movies. I have met no trustee of any institution who wouldn't admit he felt the same way at times.

Of course our meetings are by no means all of that sort. I have tried to get at the reasons why any of them should be, and it seems to me that there are at least two: first, that we sometimes forget that we are no longer an administrative body, but merely an advisory one; and second, that an ill-advised or fortuitous piece of legislation makes us spend — and inevitably waste — a lot of time over the bills for maintenance.

In the old days the trustees used to buy land, plan buildings and put them up, whereas nowadays the very most that they can do in this connection is to get a chance to say that they don't like what's going to be done. (Acts of 1914, chapter 762, section 8, *j.*) When we forget this radical change in the functions of the trustees, we are sure to waste time by going through an old-time routine which once had its purpose, but is no longer of the slightest use or significance.

The other way in which we waste time is, as I have said, in connection with the approval of the monthly bills for maintenance. In some institutions the custom has existed of appointing a finance committee to approve the bills, or of having them approved either by certain designated representatives of the board acting as a committee, or else by a majority of the trustees acting as individuals. As these bills have had in every case to be approved by the State Auditor, no harm has been done by any of these methods, even though all of them are of manifestly doubtful legality. At Worcester we have for some time had the bills approved by a majority vote at a properly called meeting, and the ruling of the Attorney-General on the Auditor's duty in this respect, as defined in the analogous provisions of chapter 6 of the Revised Laws, will compel all the institutions to conform to this practice. I heartily agree with everything that Mr. Edmund A. Whitman said at the conference in May, 1914, about the futility of attempting to pass on bills at a trustees' meeting, and I very much hope that the State Commission will secure an amendment to the law, so that we may all be relieved of an onerous, time-consuming and unprofitable duty.

Casting tradition aside, and looking at nothing but the existing law, what do we find the specific duties of the trustees to be, and are they worth performing? Outside of the submission of an annual report and the approval of bills, they are threefold: first, to administer any trust funds which may be given to the institution; second, to maintain an effective inspection through monthly visits of two trustees, and an examination of every part of the institution at unstated intervals, with special reference to cleanliness, restraint and diet; and third, personally to hear and investigate the complaints of inmates and employees. Of course the administration of small trust funds is a fairly simple routine matter; but looked at with a fresh eye, I wonder if these other duties, developed in their performance to the last detail, are after all so insignificant? In the old days these duties of necessity occupied a secondary place; to-day, whatever else the trustees do or do not do, they ought to do these things and do them well. Is it not possible that we can make our work more profitable by frequent concentration on them?

I have no doubt that intensive thought would hit upon some plan whereby the visitations and inspections might be made something more than what they too often degenerate into, — an interminable tramp over miles of battleship linoleum. Might it not be practicable to give each trustee a special allotment of certain wards, where he should go oftener than to the others, and where he would come into closer touch with both patients and nurses than would otherwise be possible? This is the sort of concrete question that I believe needs thought and discussion.

Again, we give a good deal of time to the investigation of the complaints and requests of patients. The law puts the complaints and requests of employees upon the same basis. What can the trustees do to make this latter provision of law thoroughly effective, without subverting the discipline of the institution? At present I have reason to think that nurses and attendants often feel that if they want to make a serious complaint or a significant suggestion to the trustees, they might as well pack up their trunks beforehand. Is this a necessary condition, and if not, how can it be improved? Would a complaint and suggestion box, with the promise of secrecy when desired, do more harm than good or *vice versa*?

Thus far we have been dealing with the interpretation and development of the trustees' specific duties. They are also charged with "the general interests" of their institution. If that somewhat vague expression is to mean anything at all, to my mind it can mean but this one thing, — constantly consulting with, assisting, and most of all encouraging the superintendent. He is doing a big piece of work for which he is specially fitted, while most of us, if experts at all, are experts in other lines. Anything that gives him confidence and enthusiasm is instantly reflected in the institution. There is one fundamental unwritten rule which all trustees should bear in mind, — "Trust your superintendent, and if you stop trusting him, see that he is discharged or else resign yourself."

Everybody wants to do his best, and there is every reason why we trustees should constantly strive for greater efficiency. But if we do so strive, and the results sometimes seem negligible, we can at least take comfort from the occasional appreciation of our efforts that the patients show. A discharged inmate of our hospital once said this to me: "If you trustees never did anything but walk through the place once a year, without speaking a word to a soul, you'd be doing a job that you ought to get paid money for."

Mr. Herbert C. Parsons, trustee, Wrentham State School: — I have not entered into this discussion this morning because I felt that I had nothing to say, but the most obvious thing, perhaps, is that it is not worth while for trustees interested in public work to have their time occupied in hearing the obvious thing said. I have a very strong personal feeling that the changes in the statutes — in spite of the fact that they have to a very great degree changed the scope of the detail duties of the trustees — have not gone far in the direction of relieving the trustees of the responsibility that rests upon them, and have by no means gone so far as to remove in any essential feature the localized interest which the trustees represent. I discover nothing, aside from changes shifting the responsibility as to details, in the changes in the laws under which trustees operate, which has, after all, very seriously invaded the territory of the trustees in the Massachusetts conduct of its institutions for the insane and feeble-minded.

We have recently seen that the Massachusetts system of local administration boards is recognized the world over, and that such a system had its real reason in the moral support of the institution, in its organization, and in the advisory duties which it performs, and that, actually, the things which it did in the way of detail business were really of very much less value to the Commonwealth than the advisory work that it performs in the support of its superintendent and of his work. For ten years we have been working at Wrentham in the construction of an institution and in the building up of a policy for the institution, and, to a degree, for the Commonwealth as to dealing with the feeble-minded. We are aware — and yet not very deeply aware — that the changes in the laws have altered somewhat the color of our duties. Personally, I am not very much conscious of being a really different sort of public official from what we were under the old régime. I feel that all public service, whether of the kind that we are interested in or of any other branch of the Commonwealth's various functions, is altogether too much hampered with the exaltation of personality, and that there is too much thought given by public officials to the limitations of one's authority and of close, intensive study of the limits of one's responsibility and duty.

This is the big task that we have before us in the administration of these institutions: the task of carrying out the will of the people of Massachusetts as to the way in which these institutions are carried on. This shifting, from one local board over to a central board, and from a central board over to a local board, of certain of the duties and responsibilities does not seem to me to have very seriously affected our obligation to carry out the wishes of the people of the Commonwealth.

When it comes to the details of our work, the trustees of the Wrentham State School can bear witness to the very large occupation of our time, — which is peculiar, of course, to the feeble-minded institutions, — with applications for discharge or release on parole from the institution, for our monthly meeting is largely a matter of dealing with those cases. At that time they become somewhat tedious and annoying, but we have to bear in mind that this is one of the most important problems we are working out as to the feeble-minded, *i.e.*, as to how far it is possible to relieve the feeble-minded schools of their custodial care of these inmates, and to develop, not only as individuals, but in a general way, a policy of out-care of just as large a number as possible of those who are committed to these institutions. In dealing with this problem, we are not dealing with it altogether on the technical side as to each individual case, but are occasionally aware that we have a problem on our hands which is of very general interest to the Commonwealth, and that in working out a policy for that institution, we are working out a policy for the whole State in its bearing with the problem of the feeble-minded. Even though the trustees may have been somewhat relieved of definite responsibilities and now have less sweeping powers in the matter of administration, they may still remain a very large factor in the working out of the policies of the Commonwealth and in the wisest general conduct of the institutions.

I think that the superintendent of the Wrentham State School, if he were here to take a part in this discussion, would say, what I know he feels very deeply, that the support, the counsel and advice that are given him in the whole management of the Wrentham State School by his trustees amply justify the existence of a board of trustees.

I do not think, even under the change of laws, that the trustees have become of very much less value in the actual working out of the problems of our institutions. I do not feel that we have become any less valuable to the superintendent, or that there has been any loss of that close relationship between the superintendent and the trustees which is essential to the successful management of the institution. Therefore, my general feeling in regard to this whole problem is that there is altogether too large a disposition on the part of the trustees of our institutions, as has been shown in the past, to discuss the technical rearrangement of duties and responsibilities, and if the trustees give to the superintendent the support and co-operation that any one should have in any public position, there are still very large functions to perform. I am not keenly aware myself of any changes that have taken place which have broken down or tended to break down the value of the trustees or to any very great degree relieve them from real public responsibility.

Mr. Henry Lefavour, chairman of the trustees of the Boston State Hospital expressed the opinion that the trustees still had ample duties and responsibilities. The legislation of 1914, it was true, had practically interchanged the relation of the State Board of Insanity and of the trustees to the administration of the institutions, leaving to the latter almost nothing but visitorial duties. The amendatory act of 1915, however, had restored the responsibilities of the trustees, except as to new construction, but left to the State Board the power of reviewing the appointments of the trustees and of making rules and regulations. The last provision was very wise and had not been employed as extensively as was desirable. The trustees who resigned in 1914 would hardly find any difference in their duties if they now returned to their boards.

The principal duties of the trustees now are the supervision, support and control of the superintendent, and the visitation of the institutions. The latter is, of course, of great importance, and it ought to be guided by advice from the Commission. The patients should have free access to the trustees, and a walk through the wards, which might otherwise be perfunctory, would give at least this opportunity. The suggestion that has been made as to distinctive objects of inquiry on these visits is a helpful one.

Our superintendents are able and conscientious and are more competent to advise us than we are to advise them. Nevertheless, they have perplexing questions and need our help. They need to feel that the opinion of the trustees confirms their decisions. There may well be at times the need of controlling the action of a superintendent both as to policies of administration and as to expenditures. The monthly conference is of the greatest value. The approval of the schedule of disbursements is essential, otherwise there would be no means of controlling expenditures. Should a superintendent proceed contrary to the judgment of the trustees, the latter can refuse to sign the schedule.

There should be ready access to the Commission, and more frequent consultations as to improvements and betterments. There ought, especially, to be some better method of conferring with the ways and means committee on a proposed budget. If a subcommittee of that body would meet with the superintendent and chairman of each board and discuss the questionable items, there would be no less economy, but there would be a more reasonable and practical decision as to the points where economy could be effected.

Mr. William Jameson, trustee, Monson State Hospital: — I was very glad indeed to get a notice stating that the duties and functions of trustees of our public institutions were to be discussed, for when I received the invitation of Governor Walsh to become a trustee of the Monson State Hospital, I hesitated before fully accepting it because I did not know what a man could do who had not passed through the classic halls of Yale or Harvard, and whose life had been spent in the mechanical and manufacturing industries of our State. Then the duties were made plain to me that the trustees of a hospital were to see that the administration was conducting the work effectively, economically, humanely, and according to law. The first three, I believe, I was able to pass judgment upon, but as to the latter I am not yet able to say whether or no I am qualified.

To visit the Monson State Hospital, to go through some of the wards, to talk with the superintendent, are some of the things we all do; and we like to go to the various departments and see whether or no they have a well-organized corps of assistants. To me, the engine rooms, the laundry, the storeroom and the means of fighting fire and the prevention of the same, are particularly interesting.

At the meetings of the trustees, it is always a pleasure to consider the reports of the various superintendents, to see that there is nothing wasted, and to listen to any complaints that may be called to our attention. These great institutions having been erected to care for the afflicted and maintained by the State for the benefit of everybody, — it has always seemed to me that the nearer we draw the interests of the people to them the more successful we shall be. The lack of a common interest handicaps us when we compare the State institutions with the average general hospital. The general hospital is in closer contact with the people. It is a part of our social life; people are interested in the general hospital; and charitable minded men and women are donating money for its maintenance, and in that way a large number of people are heartily associated with a general hospital.

Now, we should go a long way towards securing this; and I feel that during the past few years it is good to think this is being accomplished through the activities of trustees all over our State. Clinics such as are held in Springfield and in Pittsfield and in other cities are fulfilling these useful functions. They not only afford the advice of our best thought along particular lines, but are a large step toward bringing us more in direct contact with the public. The visiting staff of physicians that we now have serves the same purpose. The man in active practice is a good connecting link between the institution and the public. At present we do some work in the way of following up by having visiting nurses. More of this should be done. Factories have found that when a nurse was sent direct to an injured man's home and looked into the case personally to see or explain about the hospital care, or the giving of help, that this phase of the work accomplished an amount of good, and gave the family of the injured man a pleasant feeling of satisfaction that their injured one was getting all that was needed.

These are thoughts that come after a few years of experience, and, after all, our whole duty and function as trustees are summed up in the thought to serve our charges and extend the services to others where we can.

I believe that we would more amply fulfill our duty to the State if we had more of these meetings, so that some of us who have problems might be guided by the experience and advice of others.

I wish to make a suggestion — what I consider might be beneficial — regarding the possibility of increasing our food supply. I would suggest that the State send around experts to instruct our farmers to see that we raise the proper vegetables; and I believe that great good could be accomplished in that line if the services of some of the graduates of our agricultural colleges should be required to serve the State at least two years under a clearly defined head, and pay them as much as the average farmer could afford to pay them. I believe that by following up the breeding of our live stock we should be able to sell — and at a profit — registered stock that would help to bring the dairies of our State up to a higher standard. In other words, help the farmer by helping ourselves.

I have sometimes wondered if we were doing our full duty for the care of our patients when some of them are permitted to return to their homes and are returned to us in a short time and give birth to a child who is apt to become a State charge. In going through the children's wards, I wondered why so many of these little ones were committed to our care, and if the parents who are able to pay are looked up to see that they turn into the State treasury at least a portion of the expense.

These are just some of the few thoughts that come to me as I review hastily some of my experiences while trustee of the Monson State Hospital.

I believe these gatherings will do as much good for the benefit of those who are interested in the care of the feeble-minded and other unfortunates as a lot of scholarly papers on the handling and treating of the various diseases.

Mr. John B. Tivnan, member, Commission on Mental Diseases: — As a former trustee, or as Elbert Hubbard would say, a "has wasser," I have been asked to occupy not over ten minutes of your time with my views on what constitutes or should constitute "the functions and duties of trustees." We can hardly compete with Heinz of the 57 variety fame, but we can lay claim to many kinds of trustees. Because of this fact it becomes quite a problem to outline the functions and duties of trustees with the hope of anything like a majority endorsement. Experience has taught me that, despite legislative enactment and rules and regulations, individual trustees are inclined to work out their own interpretations, — some wisely and some otherwise.

It is a pleasure to note the ease with which some trustees grasp the complications that go to make up the management and direction of a big institution. On the other hand, it is disquieting to note the misdirected enthusiasm of some new members who enter upon their work with a feeling of distrust as to present policies and a secret determination to show the "old fogies" what a breezy novice can do. As a rule, this type of trustee is a specialist. He flounders around for a time and then concentrates his effort solely in one or two directions. He may be of the kind who, when inspecting the institution, thinks only of how hard or soft the patients' beds may be. Perhaps he may confine his observation to the weakness or strength of the tea or coffee, or he may give an imitation of a wise man as he passes upon the kind of bread found in the bakery. He is almost certain to ask the meek and amiable superintendent: "Whatcher pay for your flour?" and occasionally he will want to know where it was purchased. The same queries are aroused by the presence of a coal pile. Trustees have a right to all such information, as it comes quite naturally under the head of "duties and functions," but I mention it here just to show that some trustees are not eager, or, on the other hand, are incapable of exercising all of their "functions and duties." They are specialists with decidedly limited vision.

Were I to be asked to define the duties of a trustee I would first of all say: Know your institution thoroughly. By this I would mean that you be something more than a trustee on paper. Some men merely seek the appointment for the publicity it gives them and the flattery felt in the Governor's recognition of them. They attend occasional meetings, and rarely visit the various parts of their institution. This type of trustee is a grievous mistake. They are dead wood to the governing body. On the other hand, they can and do, in too many instances, become regrettable nuisances to the earnest, zealous and really helpful trustees. The indifferent and inexperienced trustee is quick to assert what he terms "his rights in the premises." Too often he gathers his inspiration and direction from disgruntled subordinates employed in the institution. To him every bit of idle gossip constitutes a serious defect in the management in the institution. He feels free to condemn after having heard one side of a story. It is for that reason that I say at this time that the first duty of a trustee is to know the superintendent, and by knowing him I mean to know his policies and plans. He is the individual of greatest responsibility. When a man is elected superintendent, it is because the trustees recognize in him one competent to fill that very important position. By so doing they have expressed confidence in him. Upon him they have placed all responsibility. At this stage it becomes the duty of the trustee to refrain from meddling in the management of the institution by unreasonably seeking favors for friends and other supplicants for patronage. Since you have voted confidence in your superintendent you should give him full rein in the management. When he fails to measure up to the right standard, you need a new superintendent.

It has been my experience that superintendents are deeply appreciative of the advice and counsel of their trustees. Institution management is sufficiently complex and trying in these days without the added complication of a divided sentiment between members of the board of trustees and the superintendent. Because of their training and intimacy with the work I have always been inclined to look up, rather than down, to superintendents. Massachusetts is and has been particularly fortunate in her superintendents. They are men of large caliber. For this reason trustees can, as a rule, look to them for direction and initiative. By this I do not mean that trustees must be of the mollycoddle type, with never a suggestion looking to the betterment of the institution. They have full rights in the premises, but their functions and duties can be definitely defined by the manner in which they show by intimate knowledge and earnest, honest endeavor that successful management can be brought about only by the hearty co-operation of trustees and superintendents.

Complaint is heard from time to time that the duties of trustees have been abrogated, curtailed or transferred to the supervisory board. Certain changes have taken place. Some of them are immaterial. None of them are of consequence if a trustee means to be genuinely helpful to his institution, Allowing that certain duties have been transferred to the supervisory board, you may rest assured that this body is keen and quick and furthermore pleased to recognize the suggestions and recommendations coming from zealous and well meaning boards of trustees. The task is the same regardless of how the work and responsibility may be subdivided. It should never be a question as to what the Commission or the trustees have accomplished as separate bodies, but rather what we have accomplished as helpful citizens of the Commonwealth.

The loyalty, devotion and sacrifice that has for many years marked the careers of the representative men and women in their trusteeship of our State institutions is well known and worthy of emulation. These worthy people have established the standard. Rules may be formulated by Governors, commissions, trustees and others in authority, — these are a necessity, — but after all, our truest guide must be the rule of the heart, — the inner promptings that lead conscientious men and women in the absence of all rules to work in entire harmony and to earnestly co-ordinate their efforts for the common good.

Dr. George W. Gay, trustee, Wrentham State School: — When the great change of 1914 was made, a good many trustees felt that they might as well resign their positions, and more than one resignation was written to the Governor.

As Mr. Parsons just said, at the Wrentham State School we have noticed no particular difference. A good many buildings were constructed under the old system, and whatever has been erected since that time has been constructed along the same lines that we established. No criticism has reached the ears of the trustees and no changes of importance have been suggested.

This same feeling that was indicated by the first speaker prevailed in our board of trustees, and our chairman at different occasions took the liberty of expressing his mind quite freely; so much so that the superintendent one day not long ago took the board of trustees in hand and expressed the same idea as to the support of the board of trustees to the superintendent that has been expressed here to-day, and he expressed himself so cordially and so warmly that I think he convinced the trustees that we were of some importance to the superintendent. I know, personally, that I felt a great deal better after the superintendent had made his remarks as to how much he depended upon us.

There is one point I have noticed and felt pretty strongly. Our board of trustees at Wrentham does not have quite as intimate relations with the Commission on Mental Diseases as is desirable. Of course that Commission is a very busy body, has a lot of institutions under its charge, and it would be possible to flood it with the interviews of the various boards of the Commonwealth. It has seemed to me advisable, and I wonder if it would not be practicable, for each board of trustees to have one or more of its members (one would be plenty) appointed to interview or have communication with the Commission on Mental Diseases at certain times whenever there is anything to be said; and our board could establish a close relation with the Commission in that way, and we all should know how things are going on, not only through the superintendent, as we do now, but also through representatives of the trustees. That is the principal thing which occurred to me.

Dr. Albert Evans, secretary of the trustees of the Medfield State Hospital: — While I think that Mr. Parsons has answered the first speaker (Mr. Gordon) pretty thoroughly, — in whose remarks there appeared a note of worriment with regard to the "well-defined duties and no powers" of the trustees, — I take it that the function of the trustees is a good deal like that of citizenship; — the law grants citizenship, but puts no limitations upon the exercise of virtue. If a trustee's activities take on the nature of meddlesomeness, the most he could suffer might be a rap on the knuckles; he need not sustain a sore heart.

When I first went on duty at Medfield, from the start I was on the trail of certain things; but our superintendent gave me poise and direction without inflicting hurt of any kind; and, being soon appointed on the consulting staff of the hospital, I became particularly interested that certain chronic surgical conditions, which were being lost sight of, might gain the attention of the resident staff. Really, the upshot of my zeal was to have a resident staff alive to the incidence of all manner of disease, — the very thing the superintendent most needed and desired himself.

I cannot believe in the necessity of taking down the statute books and saying, "look here! look there!" For instance, "let us see what the building laws are;" because, as a matter of fact, some of us are so situated that we pay rent for our homes, and are happily unconscious that such things as building laws exist. I think that it frees a man, in a way, not to know too much about the laws. I cannot believe that there is anything available in the well of my own enthusiasm, which could be of use to the superintendent in the discharge of his trust, that the law forbids, or would be likely to bring mortification upon my own head.

I do not believe that we, as trustees, have much to complain of in the law's limitation of our "powers." In fact, as it is, we are far more likely to allow vital concerns of our institutions to languish for want of personal vigilance than for want of more power.

Regarding the words of the old lady patient quoted by Mr. Gordon, "If you trustees only came round once a year you ought to be well paid for it," I think that we are pretty well paid for our labors as it is. I feel that my citizenship, that cost me no money, has taken on higher valuation in that I am asked to serve the State in a capacity above financial reward. A man situated like Dr. Kline of the Commission, and paid by the State, in a position of great power, may need the limitations of the law to guide him, for thereby hangs the budget.

Great is the power of suggestion, and that resides with the trustees. Many times our superintendent has been glad to make use of suggestions emanating from his board. I look upon the superintendent as the equalizing heart of a great home; and he should have plentiful material from which to make good blood. I think he will get that in large measure from the body of his Board; and, certainly, the necessary stimulation for sustained effort will have additional force from knowing that the soul of the trustees is with him.

As to our relations with the employees: the intimacy that may develop can do no violence to the discipline of the institution when complaints, which may or may not amount to much when sifted down, are listened to and taken up through the superintendent.

In spite of the fact, so a complaint runs, "we are not allowed the power to put up our own buildings," there is infinite possibility for the exercise of trusteeship within those buildings; and I do not care how much the law limits the trustees in that regard.

It has been emphasized that about all we are allowed to do by law is to make up the annual report. Nobody reads that but the printer, I believe. Only the obvious is embodied therein, and it can produce no effect on the people at large; we expend little zeal on that score. If we were merely the "go-between" of this great, powerful Commission and the superintendent, we have everything to be thankful for. As a matter of fact, we are more than that: we are the custodians of the comfort of the public that all goes as well as is possible with their irresponsible relatives and friends committed to our institutions for the mentally diseased. I am proud to be associated with you. I know something of what Massachusetts stands for. The year it was my privilege to attend the annual meeting of the American Medico-Psychological Association at Old Point Comfort, I heard on every hand, Massachusetts this and Massachusetts that. It so happened that the industrial exhibit from Medfield took a blue ribbon; and I heard several men say that "Massachusetts was alive and wide awake in her care of the insane."

Mr. Ellerton James, secretary of the trustees of the Wrentham State School: — There is one thing that I think we cannot emphasize too much, and that is, get behind the superintendent! Do not hamper the superintendent; get behind him and make him do the work right. If he does not do the work right and the institution is not run to the satisfaction of the trustees, fire the superintendent. It is the duty of the trustees to make criticisms, when needed, to the superintendent, and if big enough criticisms and he won't make a change, discharge the superintendent. Otherwise, stand behind him.

Dr. George M. Kline, director, Commission on Mental Diseases: — Dr. Gay's criticism, I think, is a just one, — that the relations between the various boards of trustees and the Commission are not sufficiently close.

I think the Commission plans some time in the near future, as soon as it has developed a State-wide policy, to have consultations with the boards of trustees, to visit every institution on their trustee day, and to define what the trustees' duties are in the State-wide policy. At that time we can get together upon some agreed plan to develop, not only for one year but for a period of ten years (because we feel that we will look forward to at least that length of time), that will meet with the approval of the trustees, the superintendents and the Commission.

Dr. Lefavour's criticism regarding the budget system, and the general criticism of the approval of bills, I was very glad to hear. I think a change will be proposed this coming year regarding the approval of bills.

As you know, no committee of the trustees audits bills at the present time. They go to the Auditor and are audited. As a matter of fact, it occurs to me that the Auditor can check up the amounts, but he does not know whether or not the bills should have been contracted in the first place, and so there are changes under consideration to improve this very criticism. Possibly the Commission will establish a new department to look over and audit the bills before they go to the Auditor's department. Another way to improve the situation is to have submitted a monthly or quarterly statement of expenditures of each institution.

This last year has been spent, as you know, in making up the maintenance budget at the beginning of the year and submitting it to the Commission for analysis. The Commission has gone over it with the superintendents of the institutions, suggested changes, and endeavored to have a common meeting ground before we went before the ways and means committee. I assume, of course, that these changes have been laid before the boards of trustees by the superintendents, and that the trustees are familiar with the maintenance appropriation before it is presented to the Legislature. The Legislature this year, I am free to say, has accepted the analyses which were arrived at by the Commission, with the aid of the superintendents, and, as I say, I have assumed, with the approval of the boards of trustees.

Despite changes in the law controlling the reorganization of the Commission, as a former superintendent I feel that there has been no change in the attitude — certainly there was not at the time I was superintendent — of the superintendent toward the board of trustees or the board of trustees toward the superintendent. All the problems of the superintendent were laid before the board of trustees just the same as when they had control. I should not think that there would be any difficulty in that direction. The whole matter is in the hands of the trustees, and the law specifically states that they shall appoint the superintendent and can remove him for just cause. If you want anything from the superintendent that he is not accustomed to give, it would seem to me that you can very easily get it; and if his work is not up to the standard that meets with the approval of the trustees, then you have the power to remove him.

So, after all, despite the changes, it does not seem to me that in the actual working out of the duties of the trustees there need be much anxiety over the actual change that appears in the statutes. I am sure I would like to hear from any trustee here.

Mr. Thomas F. Dolan, trustee, Westborough State Hospital: — Two things come to my mind very frequently in my capacity as a trustee: first, for the past two years I have been constantly finding out how little I know about the work; second, when I do find something that ought to be done, and try to do it, I realize how little I can do as a trustee. The gratification I find is in being associated with the trustees of the Westborough State Hospital, and, primarily, with our superintendent, Dr. Spalding, whom I consider a very good business man and an able director.

Just a suggestion in regard to the bills. We have a whole lot of bills on our desk every month, and no trustee knows much about them. As a matter of routine, in a perfunctory way we go over these bills, but we seldom find any mistakes in them. I think it is ridiculous for a busy lot of trustees to be bothered with things of that kind when eventually all bills must come before the Auditor's department and be looked over by that department. I sincerely hope some method will be adopted by which we can avoid the necessity of going over these bills every month.

The rest of the work is fairly enjoyable, and I think, when our duties are summed up, the principal thing is to stand behind the superintendent. We have such a highly efficient superintendent at Westborough that it makes our work very pleasant, and we are all glad to serve with him.

Hon. Albert L. Harwood, chairman of the trustees of Wrentham State School: — I think Wrentham is pretty well represented here to-day. I think Mr. Parsons and Dr. Gay expressed their opinions very well.

There is one point I would like to bring out, and that is, that I get closer to the institution not by going around and seeing the institution, but by making an appointment to see our superintendent and sitting down with him in the office two or three hours and going over the details and finding out about the school. In that way I get more closely in touch with the institution. I do not want the whole board around; I want one or two. I find that we can get on much better by having not more than two of the trustees at a time sit down and in a social way go over the various things; and we come to the root of things better than we could at any other time.

So far as the trustees are concerned, they have plenty to do. Some things have been taken away, but I do not know but what that is just as well, as I have seen it, so far as the buildings are concerned. When plans are drawn up they are gone over by the superintendent and submitted to the Commission on Mental Diseases, or they submit them to the superintendent.

We have a chance to get at these plans, and if there is any fault to find, we have a chance to find it, but we have not as yet had any trouble about new buildings.

Of course, any one of us likes the power of initiative, but it does not make much difference. If the institutions of the State run better in this way and are more efficient, then we should all be loyal to the system and help to carry the work on. It does not make much difference about the individual trustee, what he likes or does not like, it is the efficiency of the institution, the proper expenditure of the public money and the care of those unfortunates that counts, and if these can be made any easier, we all should say "God speed it."

Margaret A. Cashman, secretary of the Board of Trustees, Grafton State Hospital: — I would like to say a word in Mr. Gordon's behalf, for I think that his paper has been rather severely criticized. I do not know Mr. Gordon personally, but from his paper I inferred that he wished to bring out for discussion a viewpoint often taken by trustees.

I think we should all be grateful to him for presenting this phase of the subject and for the opportunity of having it discussed, for I think there are few of us who have not at some time or other had a feeling of discouragement with the apparently meager results obtained from the time, energy, thought and sacrifice given to the duties of our stewardship.

The information gained from the remarks of a patient, as quoted by Mr. Gordon, should bring to us much consolation and encouragement; and if we are successful in conveying a little happiness and cheer to even one poor patient, we should feel well repaid for all that we have done.

Mrs. Mary Agnes Mahan, trustee, Foxborough State Hospital: — The question of approving bills has bothered me very much indeed. Half of our bills have been paid when the finance committee sees them, and the other half are unpaid. I do not know that we have any more control over the unpaid than over the paid bills. They have been incurred, and they are properly vouchered, very carefully vouchered; at least five men account for everything we buy, and I do not think there is any doubt that everything is done properly, but, really, if anybody were to ask me if I know about them I should say "No." The bills appear to cover exactly what we need, and there never seems to be anything extravagant. The prices seem fair, and three of us have been dutifully signing these reports and schedules. At first we were very zealous, as we were a new institution to take the place of the Foxborough dipsomaniac hospital. We very carefully added, multiplied and subtracted and spent four or five hours in this way, and perhaps once or twice found a little error. We learned later that the Auditor's department was to do that part of the work. The last three times we have taken these bills up at board meeting, and we have greatly reduced the time spent on them. Because we are expected to sign a statement to that effect, we feel that we must read the bills through. We might well be saved from that work, though I do not know how it can be done.

We have for superintendent a man of initiative and ideas who has gone ahead. Are we a real influence? Our superintendent has said, "I have you back of me. I feel I have you behind me when I do things."

Hon. Albert L. Harwood, chairman of the trustees, Wrentham State School: — There is one thing that occurred to me. When flour is going to be bought in any quantity, the superintendent mentions to the trustees "I can buy flour for so much," and tells us the grades. We then have an opportunity to see what the market is and to see whether it is wise to buy or not. Coal is another large item. A lot of little things are bought that I do not think it is worth while for the trustees to give very much time to, but all these big things can be submitted ahead and the trustees pass upon them as to whether it is wise to make that expenditure or not. That is the most important part of the work so far as the bills are concerned.

Mrs. Sarah J. Rand, trustee, Medford State Hospital: — It seems to me that if you yourself keep a record of the analyses of expenditures of each month you will note any increase. If you think it excessive, then you are able to ask intelligent questions, and without conducting yourselves on that line you do not get an intelligent grasp of the constant needs of the institutions, — clothing, material, etc., also coal. I speak from experience. I myself do not believe in this going through every bill, because you hire the superintendent as your executive man and he knows whether these bills are proper, and what you have to do, it seems to me, is simply to endorse him. The State requires the signatures of three trustees, and, therefore, we must sign the bills.

Mrs. Helen B. Hopkins, trustee, Boston State Hospital: — I feel that our responsibilities as trustees are at times very serious.

We have the power of appointing our superintendents and treasurers, and of confirming the appointments of all officers in our institutions. The progress of our institutions depends very largely upon our relations as trustees with the superintendent. It behooves us to know just as much as it is possible to know about progressive work for the insane in our own State and other States. We should study this work, so that we can make and confirm these appointments intelligently. I think the responsibility is particularly great because most of us realize that even now our hospitals are still in a state of transformation from merely custodial institutions into real hospitals, and they never can become real hospitals until we have much larger resources at our command. I think we and our superintendents should be awake to that situation, especially if we are going to take that progressive point of view, so that the work may grow and develop. Merely making up the budget, which we have not very much power to back up, will not do it. I feel that our power to accomplish any progressive work has been greatly hampered by having our budget so cut that we are not able to pay adequate salaries, and I wonder if there is any more direct way of coming into contact with the Legislature. I would be glad if some one in service a longer time than I would suggest some way in which to make more definite appeals and get a more intelligent hearing from our progressive legislators.

Dr. George M. Kline, director, Commission on Mental Diseases: — Possibly I can answer about the salary question. It has been a very troublesome one to the Commission and has given us no little difficulty. I have conferred with the superintendents personally and I know what the views of the institutions are, or at least I think I do. I feel that it will never be right until we adopt a schedule that will somewhere near standardize the salaries of the various positions in the institutions, and then have that schedule enacted into law and have the increases take place automatically.

At the present time, I daresay, there are two or three hundred requests for increases, approved by the trustees and approved by this Commission, before the Governor and Council, and they are resting there; we cannot get them. It seems to me that it would be much simpler if we could get the Governor and Council and the Legislature to accept some schedule and have it enacted into law, so that we would not have to depend on the pleasure of the Governor and Council for each increase in salary.

There are meetings for all the superintendents being held monthly, to consider the various positions and various grades and increases for nurses and attendants, in order to get a uniform basis. The ways and means committee is ready to recognize that this year, and has granted additional money so that we can place the salaries of nurses and attendants in some of our institutions on the same basis as in other institutions, and I think we will continue that policy, once the institutions agree upon some minimum to maximum schedule for the various grades and positions.

Mrs. Hopkins: — Do you think we could make that sufficiently elaborate to permit creating new positions?

Dr. Kline: — I think all the superintendents unanimously feel that it actually works out that way.

Question: — What power have we over our training schools?

Dr. Kline: — I think you have all the power that you might wish over your training schools. The various institutions, through the superintendents and through the superintendents of nurses have been getting together in conference for the last year to formulate a uniform curriculum, with certain rules and regulations, which will be approved once it is definitely formulated. Toward that end a tentative schedule has been in effect in various institutions this year, and I think a definite schedule and uniform curriculum for the training schools for three years, will be placed in effect by the institutions this coming fall.

We have a Stewards' Association in this State which meets with the financial department of the Commission, and the purchases of each institution in each month are tabulated, if you care to look them over, so that comparison can be made with what is done at each institution, and there is no opportunity for one institution to purchase supplies of a given standard unless that information is available to the other institutions, giving them the opportunity of "getting in," so to speak, "on the ground floor." That is one of the reasons for the Stewards' Association, which is working with the Commission; and they have arrived at certain standards for certain commodities. The number of these standards is constantly increased; at the present time about 30 per cent. of all purchases are standards and are bought on specification, approved by this Commission and checked up by its chemist.

Dr. Geo. W. Gay, trustee, Wrentham State School: — I would like to ask if it would be a practical matter for the different institutions to have a field day once a year, when the Commission on Mental Diseases would visit the institution and meet the Board of Trustees?

Dr. Kline: — The law requires that the Commission visit the institutions at least once a year, and we have endeavored to send word at least a few days in advance so that the trustees could be there. It would be appreciated, but whether a stated time might be set when the Commission could meet the Board of Trustees and get together on trustees' day, I am not sure.

Dr. Evans, I think, may be able to tell us something of the Trustees' Association. That association, I believe, has had no meetings for the past year.

Dr. Albert Evans, secretary of the trustees, Medfield State Hospital: — Before the meeting disperses, I have asked Dr. Kline's permission to bring before you the subject matter of the possible revival of the Hospital Trustees' Association. The association's journal was put into my hands by Mrs. Hopkins, in which it appears that the association met once yearly up to a certain date, when all activity ceased. According to many of the points in discussion to-day, it would appear that the association could be made a very useful organization. As there are no funds in its treasury, I would like the matter put to vote this morning: Shall the Hospital Trustees' Association be revived?

Mrs. Helen B. Hopkins, trustee, Boston State Hospital: — I would like to say that I was in no way responsible for the journal of the association. It was handed to me by the secretary of the previous board, because he said that it had been given him by the retiring chairman of the executive committee of the State Hospital Trustees' Association, and Dr. Briggs gave it to me as one of the members of the executive committee. I never attended a meeting of that committee and do not know that there was any called after my appointment.

Miss Georgie A. Bacon, chairman of the trustees, Worcester State Hospital: — The Trustees' Association has been in existence for a number of years. The last meeting was held at the Taunton State Hospital. We have been in the habit of meeting annually at some one of the institutions.

A year or two years ago a letter reached me, as a member of the Board of Trustees of the Worcester State Hospital, asking for the opinion of our trustees as to the advisability of continuing these hospital association meetings, and that letter was answered. I suppose by that that a vote was being secured, or information secured from the different institutions. In discussing the question, I think that some members of our board felt very strongly that unless these association meetings were conducted somewhat differently from what they had been, there was little value in them, and that when it came to a business meeting and the discussion of questions, it was practically null and void. There was no real cause for these meetings, whereby the trustees could get into relations with the trustees of other institutions except as they spoke informally to each other while going about to see what was being done in the other institutions.

Dr. Evans: — Could we not resurrect the Association of State Hospital Trustees? Could not some one be authorized to get in touch with all the trustees of that association and have the thing taken care of properly? The journal is incomplete as it stands.

Mrs. Hopkins: — The Boston State Hospital board replied to that letter, and was in favor of resurrecting the association, but no more was heard from it. I would second the motion that the association be resurrected. So voted.

Miss Bacon: — I think the gentleman who sent out that letter was named Evans.

The third semiannual conference of the Massachusetts Commission on Mental Diseases and the trustees and superintendents of the different institutions was held at the State House on Dec. 4, 1917. The subject for discussion was: —

Food Conservation: What are you doing in the conservation of food? What new savings have you inaugurated? What suggestions have you to offer?

The views of the speakers were as follows: —

Dr. George M. Kline, director, Massachusetts Commission on Mental Diseases: — As you know, there was a meeting of the trustees and superintendents of practically all the State institutions, and many private institutions, called recently by the Food Administrator, and I think this meeting served to focus attention upon the subject for consideration to-day. The amount of money available to the institutions in their maintenance appropriations — under the heading Food — has never impressed any of the superintendents, I feel, that they could spend extravagantly, to get by at the end of the year without a deficit, and many of the suggestions that have been offered heretofore by others have long been practiced. However, the time is opportune for an exchange of ideas, and the committee having the selection of the subject thought that we were warranted in considering food conservation at this time.

Dr. Walter E. Fernald, superintendent, Massachusetts School for the Feeble-minded: — The subject of food conservation in institutions is most timely and pertinent at a time when the reserve food supplies of the whole world have been drawn upon and depleted as never before in modern times, with the cost of available food greatly increased, and obtainable with great difficulty. No one can predict how much more serious this situation may become in the near future.

No one realizes the present food problem more than those responsible for the purveying of food for the patients and employees of our institutions. Whatever happens, they must be adequately fed.

The modern science of dietetics has definitely charted the problem of feeding people. We must provide a well-balanced ration with a proper proportion of protein, carbohydrates and fats. We have a wide choice of the different vegetable and animal sources of these food elements, but we cannot substitute carbohydrates for protein, or protein for fats if we are to furnish our people with food that is satisfying and adequately nutritious.

Racial dietaries show the great possible variations of nutritious diet. The Japanese thrive on the well-balanced diet of fish, rice and vegetable oils. The European peasant seldom eats meat, butter or wheat bread. The southern negro lives largely on cornpone and pork. The typical American dietary ransacks the world for palate-tickling combinations of expensive foods, much of which is of slight nutritive value. The emphasis on palatability often means that we eat much more than we need, with resulting damage to our arteries and organs of elimination.

The scarcity and high prices of certain foods make much substitution necessary. When potatoes were costly, we substituted macaroni, rice, flour dumplings, etc. We found that turnips, cabbage and carrots furnished the bulky content or "roughage" that is a part of the function of the potato as an article of diet. Instead of wheat flour we use corn meal, bran, graham, oatmeal, rye flour, etc.

The chemists tell us that corn meal is a very hearty and sustaining food, furnishing protein, carbohydrates and fat. Our New England ancestors and the Indians before them well knew the food value of "Indian corn." Why should not institutions raise and grind much of the corn meal that could be so satisfactorily used?

Dried beans have a high protein content, and as baked beans, with pork or corned beef, make almost a perfectly balanced ration. In actual food value, baked beans are a practical substitute for meat.

Fish, fresh, dried or pickled, has a high protein and fat value, and may be used as a meat substitute much more than is now generally done, and at a much lower cost.

In food conservation in institutions the reduction of waste is perhaps the most important practical item. At the Massachusetts School for many years the waste food has been inspected, measured and reported daily by the dietitian. The immediate effect at first was to reduce the daily waste by 60 per cent. The waste food formerly fed 125 or more hogs each year, while now we can supply less than half that number.

There is a tendency to serve too large portions of food, and to serve the feeble bedridden patient with the same articles or the same quantities as are given to the hearty, working patients, with much resulting waste.

The cutting of bread in small, thin slices, and the serving of butter in small portions, with an ample supply on the table for second or third helpings, practically stopped the waste of bread and butter.

Certain patients will not touch certain articles of food, and such food ought not to be served at all to these patients.

Many of our patients can easily be taught not to take more food on their plates than they can eat. For many classes of patients if the food is placed on the table in large dishes, with individual serving, much waste is prevented.

The food which is not served should be carefully saved for future use. Indeed, the very last morsel of good food should be scraped from the serving dishes and cooking utensils. For many years we have had no bottom outlet to jacket kettles, to prevent easy waste by heedless help or patients. The food left over from the midday meal makes an appetizing supper for many patients. Constant, careful, educational supervision of the preparing of vegetables by patients or employees will cut the waste 50 per cent. or more.

Practically all of the meat purchased, if of good quality, is available for food. Every morsel of fat from fresh beef or cooked meat, if properly rendered, takes the place of butter or lard in cooking. Every kitchen should have a rendering kettle for fats in constant use. The water in which corned beef is cooked, when cooled, yields much fat of delicious quality. The excess of fats from soups could be skimmed and used. The water in which corned beef is cooked makes an excellent basis for soups. Suet can be used as a cheaper substitute for lard or salt pork for frying purposes.

The meat cutter should save every scrap of bone, and cut them finely for soup. Every bit of bone purchased should go through the soup kettles. The vertebra and leg bones are rich in finely emulsified bone marrow, — most valuable food products. The bones of roast meats should be carefully saved at the serving tables, and, after being cut in small pieces, should go in the soup kettles. Small scraps of cooked meat can also be used in the soups. The aggregate saving from all this meat utilization in a large institution represents a very large sum of money.

We have much to learn from the French in the matter of soups and stews as a source of appetizing and economical food. They can be infinitely varied in flavor, and they can be served hot to a large number of people at one time, and the full food value of the meat or lamb protein is made available, which is not the case with roasted or fried or broiled meats. The cheaper cuts of meat which are used for soups and stews are quite as nutritious, pound for pound, as the expensive cuts used for roasts and for steaks, chops, etc.

The quality of the cooking has much to do with conservation. Well-cooked food is more appetizing than if poorly cooked. Badly cooked food is much more likely to be wasted.

The food products raised in the institution gardens and farms are an important factor in our food conservation. Our people are not satisfied or well nourished unless they have an abundance of fresh summer and winter fruits and vegetables. The real food value of many of these vegetables are not measured by their theoretical food value. The berries, fruits, lettuce, onions, celery, beets, carrots, etc., which we raise and use in such large quantities, are necessary for "good living," as our ancestors called the "balanced ration." If these articles are not served, a much larger quantity of expensive food will be eaten in the unconscious effort to make a satisfying meal.

The most important farm products for their real food value are potatoes, green corn, beans (string, shelled or dry) and cabbage.

There is every reason why we should raise a much larger quantity of these food products than we do now, as a profitable by-product of the re-education and therapeutical occupation of our patients. This year for the first time scores, yes, hundreds of our female patients, were occupied in raising and harvesting the garden crops, — an innovation which they greatly enjoyed, and which was most beneficial to their health.

Our institutions nearly all need much better facilities for the storage of winter fruits and vegetables, and for the canning, preserving and evaporation of these articles. No similar investment would bring better results financially or add more to the health and happiness of our patients.

To sum up: —

1. We must furnish our people with relatively fixed quantities of protein, carbohydrates and fats.
2. We should substitute certain foods for other foods which are not obtainable or are too expensive at the present time.
3. We should make our menus so varied and well balanced that they will be appetizing and satisfying, without wasteful use of unnecessary food elements.
4. We should eliminate all unnecessary waste in preparation, cooking and serving of food.
5. We should raise a much larger variety and quantity of food products on our farms and gardens.
6. We should have better facilities for storing these farm products, and for canning, preserving and evaporating them for winter use.

Dr. E. H. Cohoon, superintendent, Medfield State Hospital: — The problem of food conservation in the State hospitals is not a new one. I think it can be said that in all the State hospitals proper conservation of food has usually been an important part in the management. Conservation has not been understood and used by hospitals in any restricted sense such as to imply a saving only or cutting down of food rations, but has been given a rather broad meaning and extensive application to include the purchasing of food, its care and preservation, its preparation, the proper proportioning, the farm production and even the use made of the garbage. For years well-managed institutions have had the conservation of their food supplies well organized and, on the whole, undoubtedly, adequate systems for such conservation were in use.

Special conditions, however, brought on by the war have of course made the matter of conservation of food in hospitals in general a much more important thing than ever before. This is true not simply because the general cost of food commodities has risen, but also on account of the difficulty in getting certain foods and because of the unusual variations in prices of the different food articles. The whole problem of the conservation of food at this time presents new aspects and has taken on new angles.

In general a discussion of the conservation of food as it relates to State hospitals presents three primary considerations: first, that of the welfare of the patient; second, that of the nation's special needs and requirements at this time; and third, that of the welfare of the State particularly as it relates to expenses.

1. In taking up the consideration of the patients' welfare it is perhaps wise to bear in mind that conservation does not necessarily mean reduction in the amount or the quality of the food to be used. It cannot be defended that patients in our insane hospitals should be restricted either in amount or quality of food to such an extent as to impair their physical or mental health, and it is my opinion that in general patients in State hospitals are not overfed. It is my feeling that in order that no hardship may come to the insane patient that there should be established a standard dietary representing the number of calories that is necessary for the proper nourishment of this class of patients, and indicating in particular the amount of animal food that should be fed. This is based upon the result of the studies of Goldberger and others concerning the diets of patients in insane hospitals and other institutions. It was quite generally found that there was a relative insufficiency of animal proteids. In addition, this standard dietary should permit sufficient change and catering to the appetite so that the best results may be obtained. This standard dietary, however, should not mean that each hospital would have to use a certain kind of food per patient on certain days, but should arrange for the average number of calories to be used, at the same time providing sufficient latitude to permit the judgment of the management as to the particular article of food to be used, and also to arrange for the best use of the products of the farm of that particular institution.

2. Our ideas of conservation, however, after having first considered the welfare of the patient, should also take into account

the needs of the nation at this particular time. It is just as incumbent upon the superintendent of a hospital to conserve his food supply from the standpoint of the nation's needs as it is upon the individual householder. He will have to follow directions regarding the use of certain articles of food and in some instances he will be required to put in his dietary food that will cost more than that which he would otherwise use. Extra efforts should be made to reduce the use of certain articles as enumerated from time to time by Mr. Hoover and Mr. Endicott. At the present time it seems particularly that the amount of wheat, sugar and fats used should be reduced to a healthy minimum. So far as I can see, wheatless days have worked no hardship in the hospital over which I preside. Partly for the reason that sugar could not be procured, the whole hospital has been on about half rations. There has been no complaint and the general health of the hospital apparently has not been impaired. Likewise, I believe the amount of fats, especially in the form of butter and oleomargarine, can be greatly reduced without pernicious results.

3. The interests of the State, of course, demand that the expense shall be as low as possible. The reduction of waste and the use of the cheaper substitute should be resorted to.

In order to meet these special requirements for the conservation of food at the present time the whole matter should, of course, occupy a position of more importance in the routine work of the hospital than heretofore. To get the best results there should be a special organization working along these particular lines even at the expense of some other part of the routine work of the hospital.

First, the hospital farm should come in for a special interest. The cultivated acreage should be increased; particular attention should be paid to raising on the farm the more staple articles of food, such as potatoes, beans and peas, which have a relatively higher caloric value, rather than greens, small fruits, cucumbers, etc. I am in doubt as to the advisability of hog raising beyond the amount of hospital swill, unless swill can be obtained from sources outside the hospital. There may be some question as to milk production. Although realizing the absolute necessity of a certain amount of milk and in no way discounting its value, I believe it is possible to use milk in such quantities, especially where it is being used as a beverage by employees and to some extent by robust patients, that its best value from a standpoint of conservation does not result. Practically the ordinary robust individual will demand a certain amount of ordinary food whether or not milk is given as a beverage. In that case it would seem that the use of milk would only increase the waste of the ordinary food served. The reserving of food such as beans, peas and tomatoes, as well as small fruits, for canning purposes, rather than to feed all of these in the green state, is undoubtedly a sound economic principle and will go a long way toward reducing the expense of the conduct of the hospital.

In order that this conservation may be effective the general organization should include a special organization relating more directly to the use of food. There should be a dietitian, whose whole time should be given to the preparation and conservation of food. Whether directly under the steward or not she will have to work in close contact with him. The dietary should be made out weekly by the dietitian in consultation with the superintendent and steward, and made out on a basis of the steward's knowledge of the condition of the food market and the special requirements of the moment. This department should be so conducted that each day only that amount of food that will represent the total caloric value should be requisitioned from the storeroom. A chart should be kept showing the number of eating units in each dining room and the proportional amount sent there. The waste — probably the most important item for consideration in the whole field of conservation — should be carefully watched. Not only should it be weighed and tabulated, but there should be supervision at every meal by responsible officers of the hospital, such as the physicians and supervisors, to see that not only is there enough food, but that there is not too much. Provision should be made to return the unused food at any one meal, to be used at the next meal. As far as possible, this department should be conducted on a scientific and accurate basis.

Custom has undoubtedly been important in establishing the dietaries in hospitals, and so strong has been its effect that perhaps we have been led to believe that certain foods have to be fed whatever the conditions. It has been stated that the dietary of the ordinary family in New England has always been considerably restricted, and I know this is true of the State hospitals. I believe, therefore, that now the time is ripe to introduce radical changes that will in the long run not only give us a wider range of food articles and dishes to be used, but at the same time reduce the cost of living under normal conditions. For instance, in the matter of fish. It is strange, but true, that people of that class from which our patients and employees in State hospitals are drawn object to eating fish. I am not convinced that this is entirely because fish does not appeal to the taste, but rather that they feel it is a cheaper and much inferior food. However, when it was ordered that fish had to be an article of diet two days a week instead of one, as had been the custom in the Medfield State Hospital for years, it resulted in practically no grumbling, and I am inclined to believe that fish could be placed on the menu even more often without provoking difficulties. I believe circumstances and the times have provided us with a most excellent opportunity to diversify our dietaries and teach ourselves that perhaps cheaper foods, especially prepared, are just as good.

The obtaining of a food supply for a hospital at the present is quite a serious affair, and it may be that we are only at the beginning of a period which will be more serious and even critical. Should we not, in addition to what is being done in the nation at large, take some concerted active steps to provide for possible critical situations? I should like to suggest that it appears to me opportune for definite action to be taken by the commissions that have charge of the institutions and hospitals in this State to arrange for some standard dietary and make such other provisions that will not only result in the food supply of the nation being conserved, but will also insure an adequate and proper supply to be obtained by the hospital.

Dr. John B. Macdonald, superintendent, Danvers State Hospital: — At Danvers the policy during the year has been to invite and embrace such help and advice touching the food situation as competent authority would provide. The excessive cost of food and the difficulty of safeguarding the institution even at exorbitant prices have been interpreted by us in the sense that a state of famine actually exists in so far as certain staples ordinarily used in the past are concerned. Early in the year, when the price of potatoes, meats, etc., assumed aeroplanic altitudes in the skies above us, we began to institute measures of safety and defence. We are able to report that, despite price increases far beyond the estimates of our appropriation, we have come through the year with a balance to return to the treasury, and a sufficient inventory to safeguard us for the immediate future. One consolation in the public calamity which confronts us, at present is that the same agencies of protection are available, and that practice should make us more perfect in their use.

The means of conservation employed have been simply substitution, economic use of supplies and control of waste, and increasing production of food from our farm.

We have gone on the assumption that the "food crisis" is not serious if available substitutes are used, and we believe that there is a superabundance of substitutes to take the place of those things which we have become accustomed to consider as indispensable. It is really a banal remark that in matters of diet we are slaves of habit, and our customs and food habits are vicious and wasteful. Our first attempt at substituting new things for what had been settled by custom, though not so good, brought us squarely face to face with the force and effect of this national weakness, which we are all inclined to admit with a sort of half-shamed, half-boasting pride. It opened the door wide to discontent and recriminations. The reaction reminded one, on a small scale, of what occurs in some drug habits, the rueful expression of deprivation symptoms on the part of patients and especially employees proclaiming that they were oppressed with a sense of their wrongs. This, too, at the very outset, because for a relatively poor food like potato, at an outrageous price, we substituted a highly valuable one. We cut down the consumption of potatoes from 100 to 18 bushels per week, using in its stead rice variously prepared, macaroni with cheese, etc. Rice at 3½ to 5 cents per pound, with a fuel value of 1,620 calories, looks pretty good to the food conservator, as compared with potatoes at prevailing prices, with a fuel value of 675 calories. We soon found, however, that the attitude of the average consumer towards these things is that the more he admires, the less he favors putting them into practice. We held our position on the question, and in time the new order was accepted by some with a fair degree of grace, and by others somewhat in the spirit of resignation to the inevitable.

It was felt it would be poor policy to follow the old custom of supplying the protein needs of our people to as large an extent as formerly by the use of meat. First, there was not meat enough in the world to go around; and second, cost was excessive. Reducing the quantity of meat and the number of days of such issue, we supplied in its place fish and other protein-bearing foods. Hake, pollock, whiting and herring, salt, smoked, kippered and fresh, were given. Macaroni and rice with cheese, skim milk in combination with other foods and beans gave a fair range of choice of protein-yielding elements. Issue of meats was reduced to three days weekly, two of which issues at present are of pork or other meat products of our own farm. The meals were not so satisfying in all cases, perhaps, because "flat" foods, as hominy, rice, beans, cheese, etc., do not tend towards the highest degree of gastronomic enthusiasm. Our cooks were urged to consider and study the art of flavoring, and they are still floundering along as best they may with that subject. Our efforts, however, showed some results, — an expenditure of $2,000 less for meats than the annual average for the previous five years. Herring, hake, pollock and whiting is issued now three days a week at a contract price of 5 cents per pound, and clams for chowder at $1 a bushel, delivered.

We are now using corn meal, oatmeal, graham flour, "Occident feed" or wheat bran in combination, or in place of white flour. Our steward reports a reduction approximating 500 barrels in the amount of white flour used during the past year. "Cer-o-lac," with a base of chestnut meal and peanut oil, has been substituted for lard at a considerable saving in money. Our share of lard is also saved thereby for those who need it most elsewhere. It is most satisfactory as a substitute. It gives more volume of bread, and keeps it moist longer. We are experimenting with peanut butter as a shortening in biscuits, and its use has been suggested in soups, etc., on account of its high nutritive value. "Golden tartar," at a cost of 40 cents less per pound, replaces cream of tartar.

Consumption of sugar was first reduced one-third, and more recently almost one-half. The use of confectioner's sugar for frostings has been stopped. Coffee and tea are now sweetened before serving. Individual servings of sugar for cereals are given out, and in most cases syrups are depended upon wholly for this purpose.

We have been guided to some extent in the daily issue of food to the kitchens by the food tables for the use of institutions issued by the Department of Public Charities of New York. These tables are used to advantage where a "waste system" is in operation, *i.e.*, a system of weighing after each meal the quantity of food not eaten. A competent assistant to the housekeeper has recently been appointed, whose duties largely will be to supervise the preparation of food and its distribution, the economical serving of food, and the weighing and charting of waste, which will serve as a guide to the amount to be issued daily to the kitchens. With this scheme in effect, the number of persons in the hospital will be the indicator in the chart, the curve of which will show graphically whether the consumption is in direct proportion to any change in population.

Food is no longer placed on the table in large quantities, but is served by waiters, each person being expected to eat what is served him before he can obtain more. We have found this a benefit all around. Waste has been greatly reduced. Appetites seem to improve when the supply in sight is limited, and the table is not littered with crumbs and broken, half-eaten food. When bread had been placed on the table for the patients to help themselves, they soon developed whims for selecting and rejecting pieces or breaking and crumbling them. Under our present system, clean plates and unlittered tables are the rule. The change was so notable at first that it was deemed advisable to have a physician go the rounds of the dining rooms to see if the patients' wants were adequately supplied. There has been no complaint or evidence of insufficient feeding. The only department grievously affected is that of the farmer, who has been somewhat upset by visions of a deficiency in grain and feeds for swine during the coming year.

Waste-reducing machinery has been installed in our kitchens and bakeries. A meat-slicer for hams, bacon, corned beef, dried beef, etc., enables us to obtain a great many more servings from the same amount of meat, and to prepare it more acceptably. Uniform thickness of the slices in itself results in a considerable saving in the course of a year, and when meats are cut thin much fat that would be rejected otherwise is eaten. Dried beef can be bought in bulk and sliced at a saving of 10 to 15 cents a pound. There has also been installed a cake mixer, with attachments for slicing vegetables, hashing meat or fish and crumbing dried bread so it may be used in brown bread mixtures, or even made fine enough to put with the flour in bread. Practically all such things not consumed at the tables can be made use of again in one way or another.

We have largely increased the use of vegetables. Our farm has yielded a large crop of peas, beans, corn, carrots, turnips, onions, etc., which go to help us out on our weekly vegetable day. We are drawing now on a canned supply of farm products, amounting to 1,000 gallons of corn and 3,000 gallons of string beans. Vegetable soups can be made most appetizingly, and are thoroughly satisfactory. There is no law against adding a soup bone, if one has it, even on "vegetable day." But, if one has not, one must be a person of small resource indeed to confess failure. Pea soup, bean soup, etc., do not demand exceeding skill in the making. In these stirring times, one or the other makes a dish fit to set before king or commoner. The day of the four-and-twenty blackbirds business is passing into memory, like other things, and we may as well cease our lamentations and "haud our breath to cool our porridge wi'."

A revolution in dietetic habits, like other revolutions, has its "teething period." The personal sacrifice of table pleasures is not made easily. But there is a psychological aspect to the process of self-denial at this time which can and should be used in the disciplining of tastes and appetites. Were it not for this, backed up by the campaign of education by the Food Administrator, I am sure we should have had serious trouble in such measures of conservation as we undertook. There has never been a better time than the present to make an effective appeal to patriotic and charitable feelings. Our trivial economies, substitutions and shifts against a time of need, may be made to assume heroic appearances. The complete readiness of our soldiers and those of our allies for sacrifice, occupies the mind of even the worst kicker on food. Use the fact. Feed it to the people in your charge by word, by suggestion, till the consciousness that they too are "doing their bit" dominates and animates them. I do not believe you could furnish a better relish for even the most tasteless meal. To this end, there should be displayed in our dining rooms food charts, such as Langworthy's and the various food placards provided from the Food Administrator's office. It is a simple task to show, additionally, in a striking way the purpose of certain economies. Who would not be satisfied with a simpler, plainer fare, for instance, if he had before him a reminder that a saving of a single ounce of meat per person daily would enable us to send our soldiers what they need?

I am sure we are all ready and anxious to do everything possible to conserve food supplies. We are studying, as never before, methods of substitution. One of the big difficulties in our way is that most of our people have not yet realized the situation. There is a vague feeling abroad, born of reports about the great crops of last year, and perhaps emanating from more suspicious sources, that there is plenty of the kind of "food that Mother made," and that all the talk about shortage is a sort of political "eye-wash." Admit your people to free counsel. Do not sing them, or allow to be sung, a song of placebo. I have an abiding reverence for all means that produce public opinion, and until we do our part by instruction, example and suggestion to the end of producing the right sort of public opinion, the will to submit to personal inconveniences will not prevail over the forces of established customs and longstanding habits.

Dr. John A. Houston, superintendent, Northampton State Hospital: — Some questions of administration of State hospitals are easily settled as matters of policies and of routine; others have to be settled periodically or occasionally; the matter of economies is with us, however, all the time, at breakfast, dinner, supper, between meals and during sleep.

The cost of maintaining an ever-increasing number of dependents is so great as to make the taxpayer groan and the legislative committees scan our estimates as with a microscope and mete them out with microtomes.

This is quite proper and it is but fair to add that directors of public institutions in the State strive to keep costs low and reasonable.

It is easy to determine scientifically the smallest number of calories that will keep our bodies in a state of efficiency. Doubtless the patients in our State hospitals could be kept alive at a smaller expense than is customary, but several things essential should not be lost sight of.

Our patients should be returned to the community as soon as possible for two reasons of policy affecting the public purse, other and more weighty reasons being unconsidered in this discussion; first, that they may cease to be burdensome to the public; secondly, that in many cases they may wholly or in part contribute to the maintenance of themselves and families. A nourishing, liberal diet will contribute toward this end as quickly as any other material thing.

Most of our patients come to us underfed and underweight, as experience shows. Experience further shows that improvement in physical condition accompanies mental improvement, and that often the latter is largely dependent upon the former. A liberal diet will promote the recovery of a fairly constant number.

Furthermore experience shows that the large number who must remain under care are made more happy and contented by a satisfactory diet than by any other thing. This is not a negligible matter. It concerns not only the patient but all his relatives, and the public at large.

For the reasons thus only briefly suggested institution dietaries more liberal than called for by the bare necessities are desirable.

But in times of stress like the present, when we are all bending our energies to one common end, it is quite right that our patients should bear their share of saving if their improvement is not in danger of being retarded. We must always keep that in mind.

We have been trying at the Northampton State Hospital to effect all the economies and the conservations suggested by various committees, by the press, and by example of other institutions, but I can mention briefly only a few of our activities.

We found that all employees and patients co-operated heartily. When notices were posted in the dining rooms reminding them that these minor privations called for are patriotic measures, the situation was accepted without protest; knowing that every one, — officers, employees and patients, — was concerned, all seemed willing to "do their bit."

We have tried to keep the wheatless, the meatless, the sweetless and almost the eatless days.

On two days in the week corn meal and rye have been substituted for wheat, and on other days an excellent bread is used, in which Indian meal takes the place of wheat flour largely.

Hominy and oatmeal replace the breakfast foods of wheat, and buckwheat cakes have returned to favor. Indian mush and milk and fried mush and syrup are satisfying. Incidentally I may here voice the hope that the impetus acquired in some of these substitutions may carry, long after the present extreme need is relieved.

Two days in the week are meatless days. I believe the majority of people leading sedentary lives eat too much meat and might well increase the number of days on which meat is eschewed. As substitutes the following among other things are found very satisfactory: a soup made wholly of vegetables (this has been so well relished that it will become a permanent part of our dietary hereafter); pea soup; bean soup; clam and fish chowder; macaroni served with tomatoes or with cheese, and in a great variety of ways; rice; hominy. If the numbers to be served are not too large, peanut loaf and also baked bean loaf are excellent substitutes. On the days other than Friday when meats are not served, salt codfish "picked up" with salt pork and potato is relished by all.

The amount of sugar used has been cut fully 50 per cent. without serious inconvenience, though a fairly liberal allowance is desirable as soon as the supply becomes plentiful again. Many are drinking tea, coffee and cocoa without sugar or with half the usual amount. Syrup and molasses are used more freely on bread and on cereals.

Peanut butter may be used at a cost of about 19 cents a pound instead of butter at 44 cents. It will be used by some as a relish, and additional necessary fats may be more cheaply served in other forms.

One effect of the conservation movement has been to increase the saving of fruits and vegetables. In former years the surplus has been canned and preserved in our general kitchen. The present year we encouraged the raising of more things that the "surplus" might be larger; in order to preserve them, and we established a separate canning department equipped with special apparatus, and engaged an additional employee to operate it. This has proven so valuable it will be continued as a permanent department.

I may mention in connection with what we have done for the institution and its inmates for the public good that we gave to each interested employee with a family the use of a piece of land, which we plowed for him, and encouraged all to make use of the privilege. The results were highly satisfactory, large amounts collectively of more than twenty fruits and vegetables being raised.

Dr. Kline: — May I ask Professor Carver to speak?

Prof. Thomas N. Carver, trustee of the Massachusetts School for the Feeble-minded: — I was not expecting to be called upon, and don't know what I am going to say. I have been considerably interested in the food yield of an acre of land under different crops, and it seems to me that possibly some of these points might be mentioned.

One advantage of the wheat and corn crops is that these articles stand transportation pretty well, but the disadvantage is that they require a great deal of land to produce enough wheat flour to keep a man alive a year. Some of the huge crops raised contain a good deal of water, and, therefore, do not stand transportation well; but, where you are growing crops on your own land, the transportation problem is eliminated. Some food products that have not been mentioned this morning have a very high value in spite of their bulkiness. The turnip, the common turnip, with a high food value per pound, yields productively per acre, and you get three times as much from an acre of turnips as you do from wheat and corn. The parsnip has not been spoken of, and I find it has a food value equal to the potato, if not higher, and responds to intensive cultivation remarkably well. It does not, however, stand transportation well. Therefore, we cannot, — all of us, — live on parsnips; but where they are grown on a limited acreage, in an abundant supply, the parsnip seems to me to hold out great possibilities, and yields more heavily than potatoes.

Ultimately, of course, this question is a question of man power. We have land enough and considerable to spare, but we need the man power to cultivate the land to grow the food. There has been an enormous increase in the demand for man power in other fields — in the war industries.

I have been asked recently about the advisability of conscripting both capital and labor for the war industries that may be necessary, — including the food-producing industries, — but it seems to me a clumsy way to do. The unnecessary industries provide employment. If there were no employment in these industries, all would be anxious to go into the war industries. One reason why there is profitable employment in the unnecessary industries is that we are spending our money for these things. If we quit spending our money, there will be no employment for capital or labor in these industries. Back of this problem of food conservation is a larger problem of conservation of man power. If we do not voluntarily cut down our expenses for the unnecessary things, the government will have to compel us to. It may cut off the supplies of raw materials, refuse the use of railroads and freight cars to the luxury-producing industries, or may even conscript capital.

There is another way that appeals to me and that is merely to cut down our income. If I put my money into a Liberty Bond, I cannot spend it. I have to economize and cut out the purchase of some unnecessary things, and I can. And again, the money which we pay in taxes, — the income tax and taxes to the government, — we cannot spend on unnecessary things. This forces us to cut down our consumption of luxuries, and spend what money we have in purchasing the necessaries. The other money we can turn over to the government to spend to do its work, — along with our efforts to cut down on such things as wheat flour and sugar. Let us take whatever addition to our taxes the government imposes on us, and be thankful that we have a chance to spend our money for the salvation of democracy, rather than to spend it for personal, temporary gratification.

I have been making my lunches, for some weeks, on corn bread and milk. I cannot see that I have sacrificed anything, and, at this minute, feel exactly as well as though I had been eating white bread, and all sorts of things, for lunch. I think it is a little more sensible than to eat white bread for lunch.

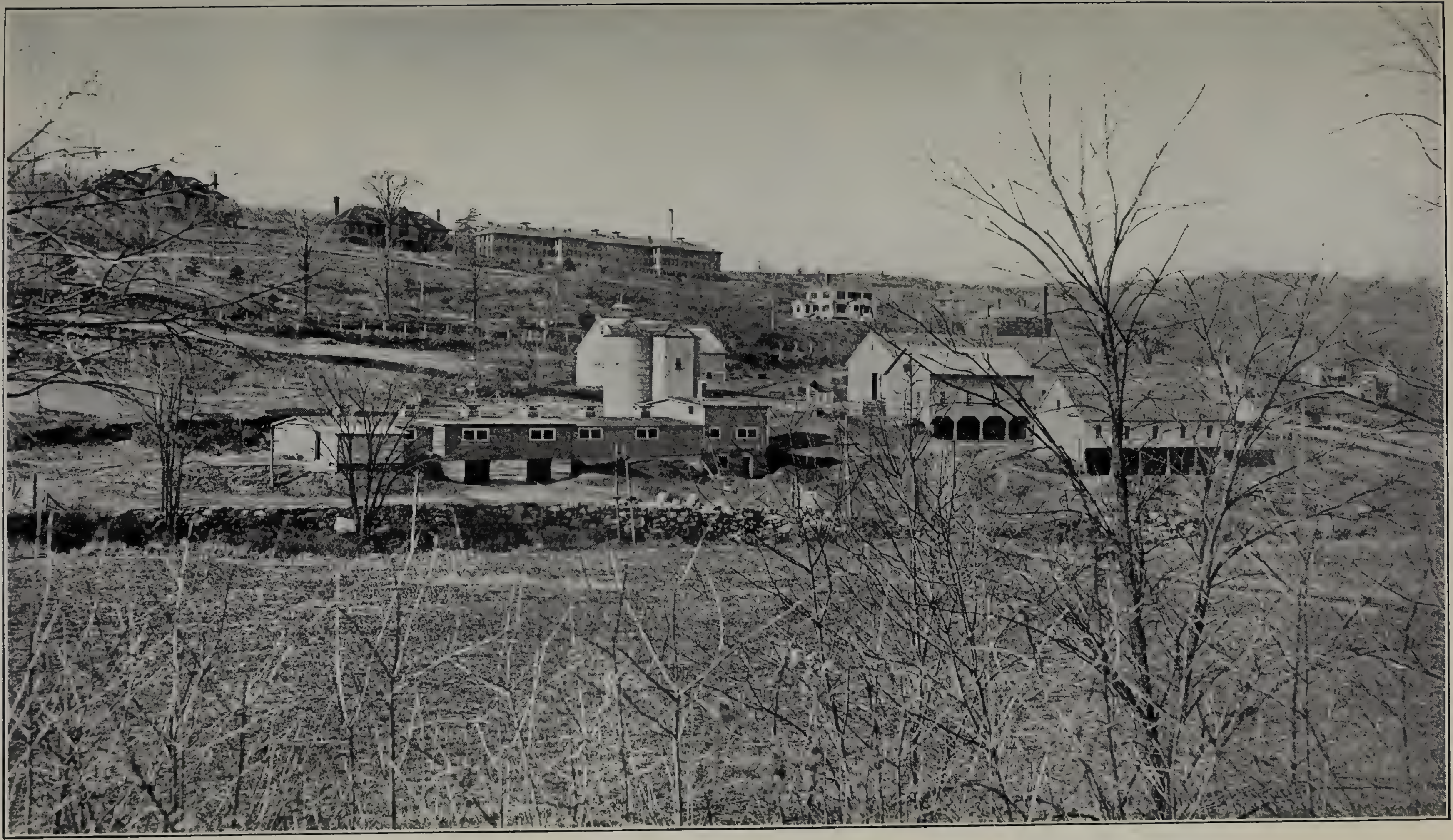
Dr. Albert Evans, trustee of the Medfield State Hospital: — Does the Professor place tobacco among the luxuries?

Professor Carver: — I don't use it in any way myself, but, if I did, I would place it among the luxuries. I think it is a necessity for the soldiers to have, but I think the rest of us may do without it. It is wholly a question of saving a little man power by consuming a little less.

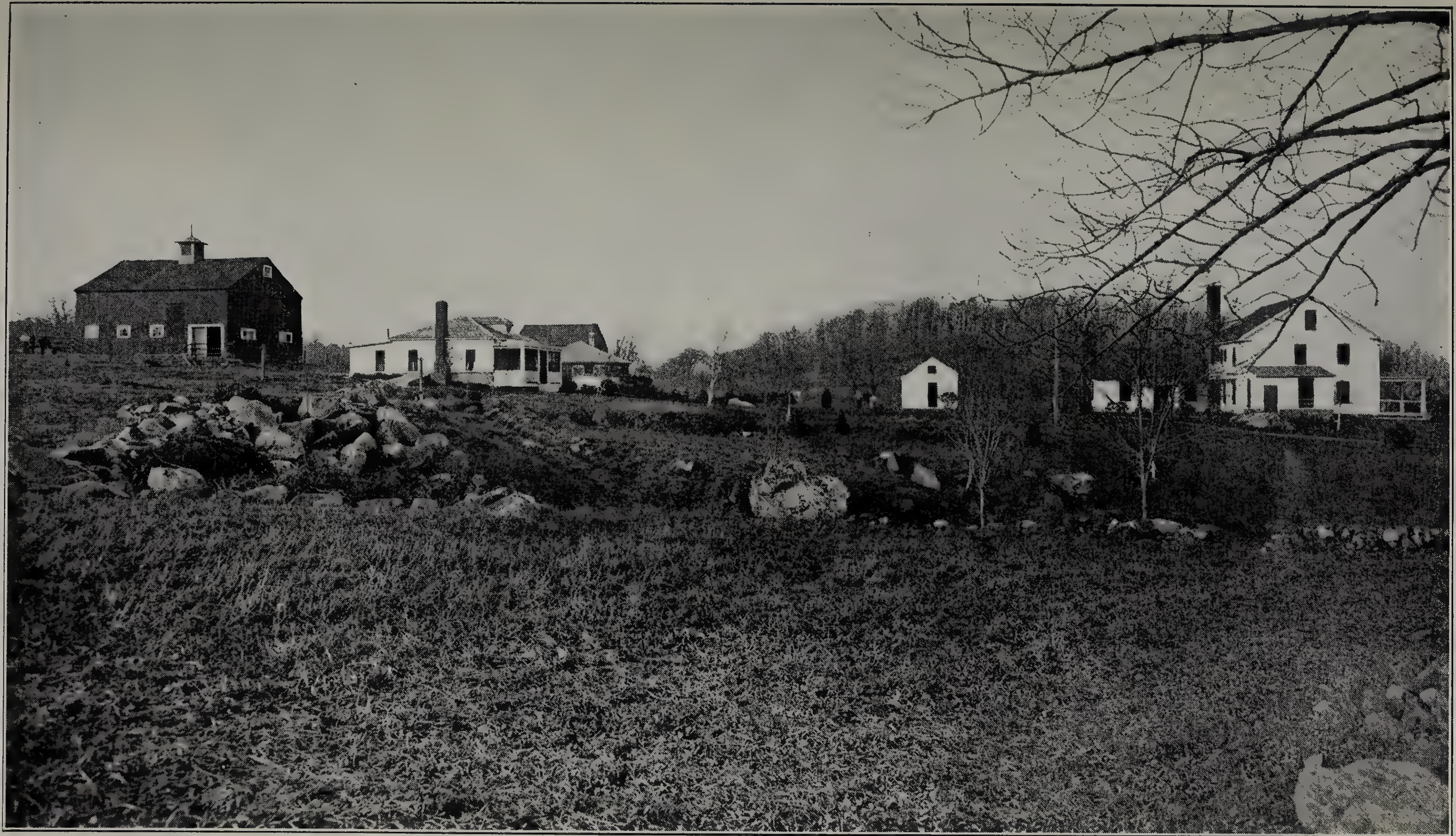
Monson State Hospital — Main Group.

Monson State Hospital — Greenhouses, Children's Colony in Distance.

Monson State Hospital — Ball Field.



Monson State Hospital — Barns, Farm Group in Distance. Three Employees' Cottages.



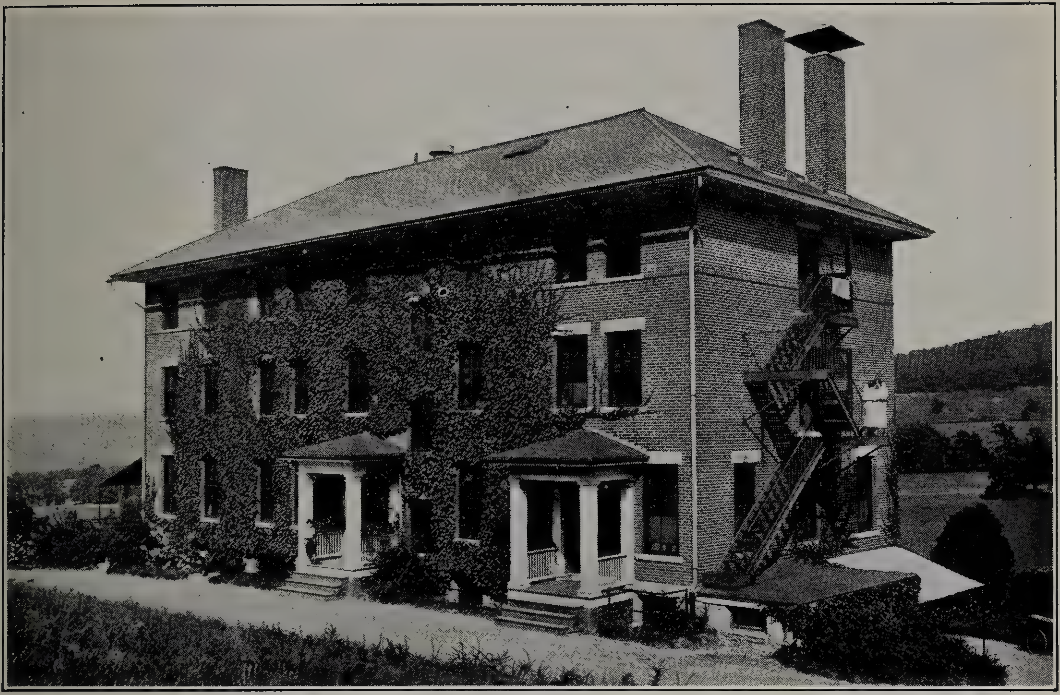
Monson State Hospital — Farm Cottage W.

Monson State Hospital — Farm Group 1.

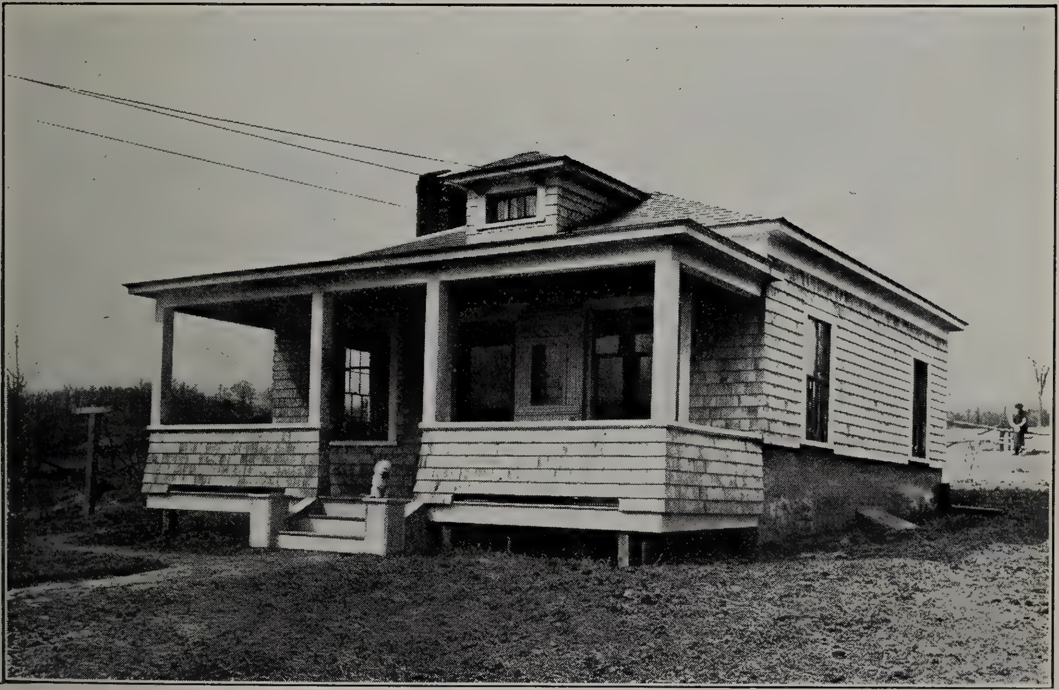
Monson State Hospital — Farm House.

Monson State Hospital — Farm Group 6.

Monson State Hospital — M Cottage.



Monson State Hospital — Colony, Service Building.



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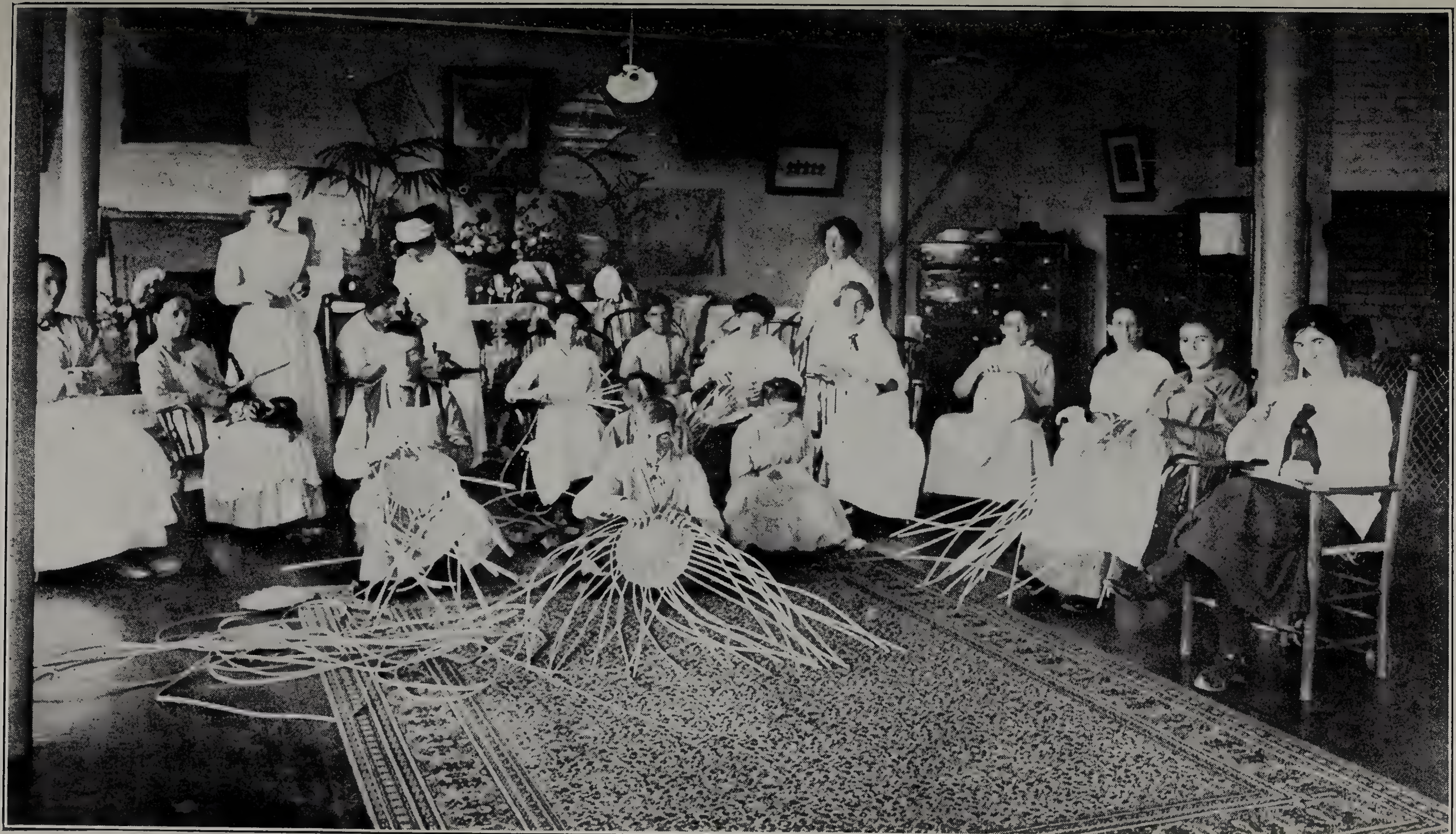
Monson State Hospital — Group of Epileptics.

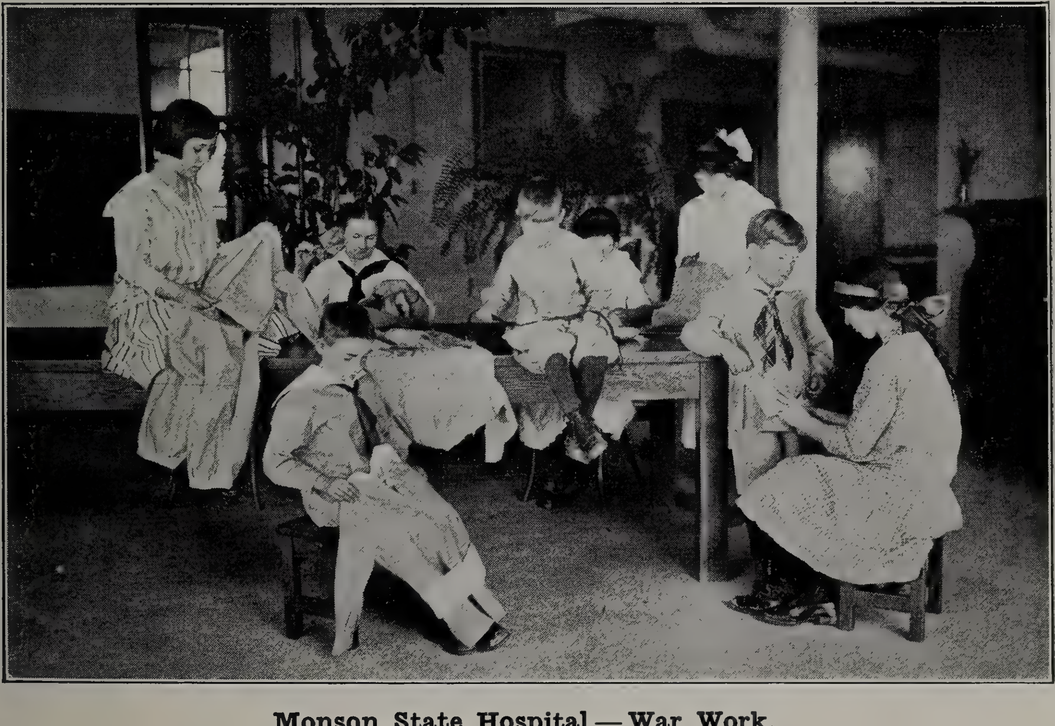


Monson State Hospital — Arts and Crafts.

Monson State Hospital — Manual Training.

Monson State Hospital — Arts and Crafts Exhibit, Industrial Room, Children's Colony.

Monson State Hospital — Grading.



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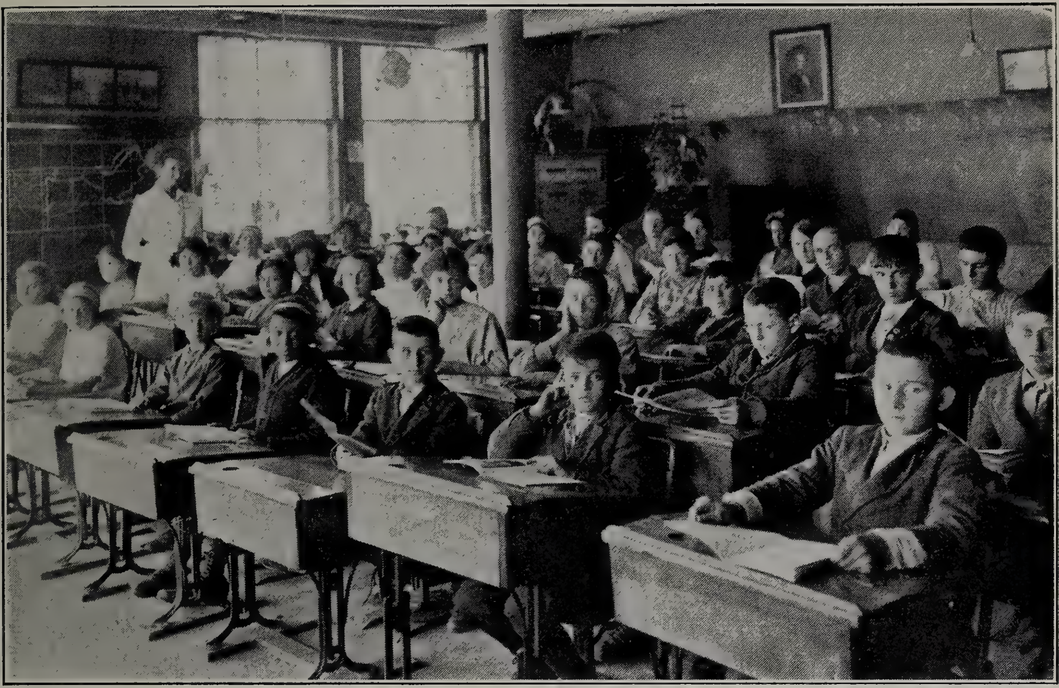

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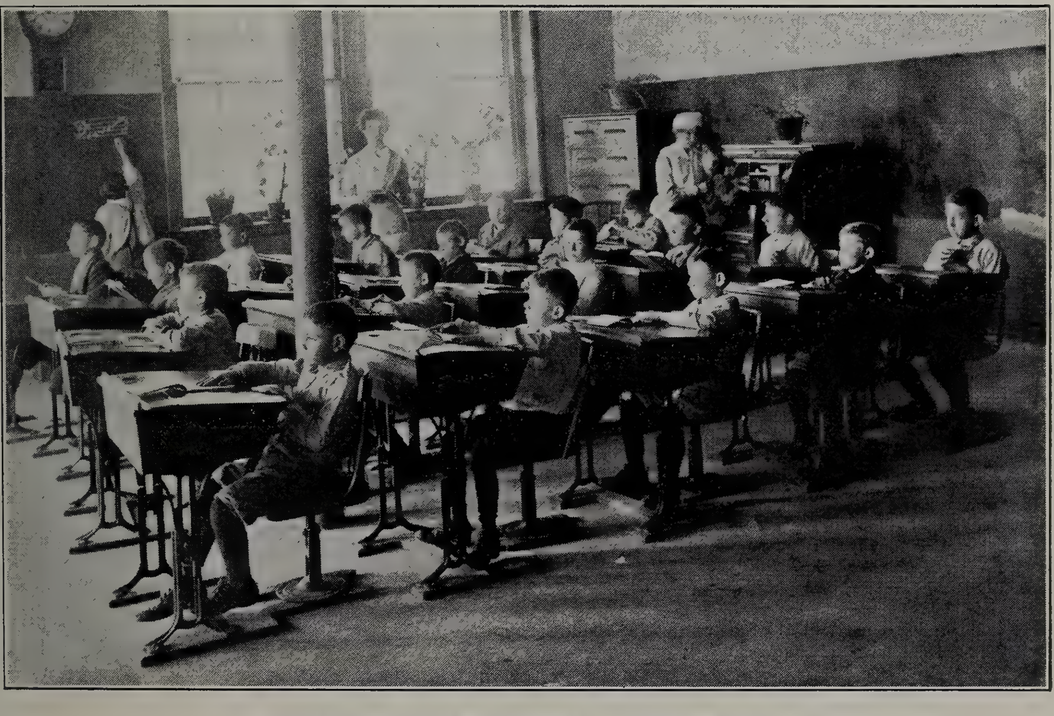

Monson State Hospital — Boys' School.

Monson State Hospital — Administration Building.

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Monson State Hospital — Children's Playground.

Monson State Hospital — Isolation Shacks.

Monson State Hospital — Women's Hospital.

Monson State Hospital — Women's "South."

Monson State Hospital — G Cottage.

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Volume II No. 3

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OF THE

MASSACHUSETTS COMMISSION ON MENTAL DISEASES

(*The William Leonard Worcester Memorial Series*)

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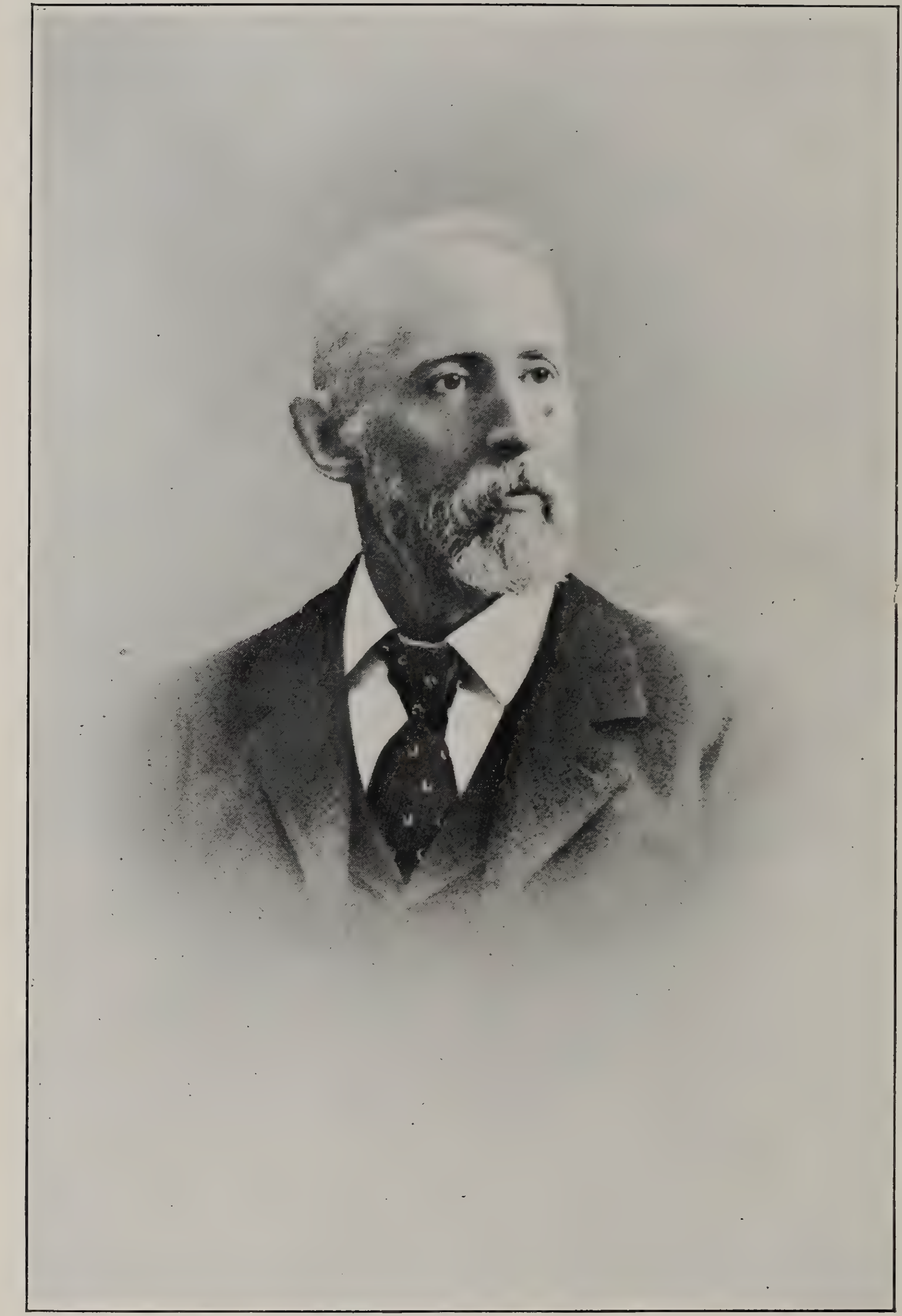

William L. Worcester, M.D.

Pathologist, 1895–1901.

DANVERS STATE HOSPITAL ANNIVERSARY NUMBER
Volume II **No. 3**

BULLETIN

OF THE

MASSACHUSETTS COMMISSION ON MENTAL DISEASES

(PUBLISHED QUARTERLY)

WILLIAM LEONARD WORCESTER MEMORIAL SERIES

PRESENTED AT A CONFERENCE NOVEMBER 19, 1915, BY PAST AND PRESENT MEMBERS
OF THE STAFF UNDER THE AUSPICES OF THE BOARD OF TRUSTEES

EDITED UNDER THE PROVISIONS OF ACTS OF 1909, CHAPTER 504, SECTION 6

LAWSON G. LOWREY, M.D.
Special Editor

OCTOBER, 1918

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SELECTED MEDICAL AND SCIENTIFIC STUDIES: DANVERS SERIES.

INTRODUCTION TO WILLIAM LEONARD WORCESTER SERIES OF DANVERS STATE HOSPITAL PAPERS, 1915.

By Lawson G. Lowrey, M.D.

The papers contained in this Bulletin represent the program of a conference held at the Danvers State Hospital on Nov. 19, 1915, in celebration of the twentieth anniversary of the establishment of the laboratory on its modern basis, with a full-time pathologist in charge. This was the first State hospital laboratory in this State to be so set apart under the direction of a man who devoted all of his time to the work. All of the contributors to this Bulletin have either worked in the laboratory as a part of its staff, or as students have accomplished some piece of work, or have, as superintendents, been materially concerned with its advancement.

This introduction gives a brief history of the laboratory and of the first pathologist, Dr. William Leonard Worcester, to whom this Bulletin is dedicated. Part I contains the addresses and discussion at the symposium upon the value of the laboratory in the study of mental disease; while Part II contains the original papers contributed by former and present members of the staff, visiting students, etc.

Historical.

The by-laws of the Board of Trustees, adopted when the hospital was first opened in 1878, provided for a superintendent and two assistant physicians. Only these three were appointed in 1878, but Superintendent Calvin S. May urged the appointment of a competent pathologist in his annual report, "to the end that, the causes and prevention of mental disease being better known, there might be less call for expenditure for the support or care of this class."

In 1879 Superintendent May reported that Dr. James Jackson Putnam of Boston had consented to accept the position of pathologist as an honorary one. In this same annual report appears a short report by Dr. Putnam, certain extracts from which are still remarkably apt: —

> The great body of the medical profession has hardly yet learned to believe that insanity is a disease of the body at all. One reason for this incredulity is, that in so many cases of this class the brain is found, post mortem, to present no anatomical traces of disease.
>
> Should they, on this account, abandon post mortem research in disappointment?
>
> Rather let them extend its scope, and they will find that the primary causes of insanity are often to be sought less in the brain itself than in the heart, the lungs, the digestive apparatus, the kidneys, — organs which prepare for, or convey to, the brain its nourishment, or which secrete from the system substances injurious to its welfare.
>
> Thus those who wish to discover the origin of insanity must join hands with those who are searching for the origin of all diseases, namely, with the general pathologists, and the field for their work must be the post mortem table, or laboratory.
>
> It is by such means as these, by joining hands with pathology, physiology and psychology, and only in this way, that the study of the causes and prevention of insanity can make real, permanent advance.

Since the time this was written have come the tremendous advances of modern science and experimental medicine, but the above statement needs only slight modification to fit in with the present ideal of the study of the causes and prevention of disease in general, and mental disease in particular.

Until 1885, Dr. Putnam was entitled pathologist, but after 1881 the autopsies were performed by members of the resident medical staff, and, of necessity, very little attention was paid to laboratory problems aside from the autopsy work.

Between 1881 and 1883 the autopsies were signed. The names appear of Henry R. Stedman, assistant superintendent, 1879–84, now superintendent of Bournewood Hospital, Brookline, Mass.; Sanger Brown, assistant physician, 1881–82, now at Kenilworth Sanitarium, Kenilworth, Ill.; William A. Gorton, assistant physician, 1882–84, assistant superintendent, 1884–86, superintendent, 1886–88, now dead; and M. A. Jewett, assistant physician, 1883–92, now (1915) United States Consul at Kiel, Germany. Between 1883 and 1895 the autopsies were unsigned.

During these years the autopsy work was carried on in a small room in the basement of the "G" section. There was no laboratory in the modern sense in which the term is used. The equipment consisted of the autopsy table (which is still in use), the necessary knives and tools for autopsy work, the ice box for the storage of bodies, and a sink. It is difficult of access, poorly lighted, and could not have been a very pleasant place in which to work. It offered no inducement to do more extensive work.

In 1895, under the superintendency of Dr. Charles W. Page, the new era was started with the appointment of Dr. William Leonard Worcester as assistant physician and pathologist, which position he held until his unfortunate demise in 1901. To Dr. Worcester belongs the credit of establishing a uniform procedure in autopsy work.

At this time an addition was built on the rear of the center section of buildings to hold the laboratory. This consisted of one large room, well lighted, for the autopsy and microscopical work, and a large entry hall.

Following Dr. Worcester's death, Dr. Albert Moore Barrett became assistant physician and pathologist, 1902–05. Dr. Barrett was educated at Iowa University Medical College; was at Worcester under Adolph Meyer and later pathologist at Independence, Iowa. After his appointment at Danvers, he spent a year in Germany, for the most part with Nissl and Kraepelin. At Danvers he was especially interested in correlating clinical conditions with the histology of the cerebral convolutions. Under him the autopsy routine was crystallized into approximately its present state. At this time, too, bacteriology became important in the laboratory routine, and a great deal of work, for the most part unpublished, was done by Dr. Louis Hoag, assistant in bacteriology, 1904–05.

At the time Dr. Barrett came, a further extension was built on the rear of the laboratory, and the first floor assumed the shape it has to the present day. Larger and better microtomes and a freezing microtome were purchased; microphotographic apparatus and camera, Zeiss II C microscope with apochromatic objectives and compensating oculars, autoclave, etc., were secured; the ammonia process refrigerator installed; and the library received more attention.

Dr. Barrett left Danvers to become Professor of Nervous and Mental Diseases and director of the State Psychopathic Hospital at the University of Michigan, Ann Arbor, and was succeeded by Dr. Elmer E. Southard, 1906–09. Dr. Southard had worked in pathology at the Boston City Hospital, and had spent two summers at Danvers. In 1902 he studied abroad in Frankfort and Heidelberg with Weigert, Nissl, Alsheimer and Kraepelin. In 1904 he organized the department of neuropathology at the Harvard Medical School, of which he is now the head as Bullard Professor of Neuropathology. During his time all of the records of the laboratory were thoroughly indexed, and a card index of symptoms was installed for all patients in the hospital.

Associated with him was Dr. Frederic P. Gay, now Professor of Pathology in the University of California, who, as bacteriologist, 1906–07, systematized the autopsy bacteriology for the laboratory and carried on special immunity studies. The bacteriology work was carried forward by Dr. E. T. F. Richards as bacteriologist, 1907–08. Dr. James Bourne Ayer, Jr., was assistant in pathology, 1907–08, before he entered upon private neurological practice. Dr. Myrtelle Moore Canavan became assistant in pathology in 1907, and held the position until she resigned to become pathologist to the Boston State Hospital in 1910. In 1914 she became assistant pathologist to the State Board of Insanity. Dr. Anna H. Peabody became assistant physician in 1906, and, until her retirement to private life in 1913, spent most of her time in laboratory work. Dr. Henry A. Cotton, assistant physician, 1903–07, now medical director at the State Hospital, Trenton, N. J., although never technically a part of the laboratory staff, was nevertheless very closely associated with it, and might almost be called a laboratory man.

During Dr. Southard's time at Danvers the chief alterations in the laboratory were in the basement, which was divided into a number of storerooms and into a large animal room. A large 16-head centrifuge, large bacteriological incubator and filing equipment represent the largest pieces of apparatus installed at this time.

In 1909 Dr. Southard resigned to become pathologist to the State Board of Insanity, and later director of the Psychopathic Hospital in Boston, and was succeeded by Dr. Herman M. Adler, 1909–12. Dr. Adler was a graduate of Harvard College and of Columbia University Medical School. He had studied at the University of Strassburg, and had been assistant in the department of theory and practice at Harvard Medical School. At Danvers he was much interested in metabolism studies and in experimental work with fats, thus bringing, for the first time at this hospital, the chemical side to the fore. He was assisted by Dr. Canavan, until her resignation, and by Dr. Peabody.

During Dr. Adler's service no material alterations were made in the plans or arrangements of the laboratory. Much new apparatus, chiefly chemical and analytic, was purchased. Some of the larger items were a Sartorius balance, with platinum plated weights, platinum crucible, a Kjeldahl apparatus, a 6½ by 8½ inch camera, with Zeiss Protar Series VII A lens, and telephoto attachment, and a very complete stock of glassware and other materials for analytical work.

When Dr. Adler left the hospital to become chief of staff at the Boston Psychopathic Hospital in 1912, the vacancy was filled by Dr. Earle D. Bond, 1912–13, who had for five years been on the staff at McLean Hospital. Dr. Bond was also made clinical director, thus combining in one man the responsibility of the scientific and diagnostic work of the ward and laboratory services of the hospital. This was the first appointment to be so made in this hospital. Dr. Bond resigned after about fourteen months to become first assistant physician at the Pennsylvania Hospital for the Insane. He was assisted by Dr. Peabody, and, following her resignation, by Dr. Alice A. Steffian, 1913–14.

No material alterations were made in the laboratory during Dr. Bond's service, and no very extensive additions were made to the equipment.

Following Dr. Bond's and Dr. Steffian's resignations, routine work was carried on by members of the resident medical staff until the writer's appointment as pathologist in 1914. The writer had been trained chiefly as an anatomist, working with Dr. C. M. Jackson at the University of Missouri for three years, and with the late Dr. Minot and with Dr. F. T. Lewis at Harvard Medical School for one year. With Jackson, his work had been largely in the subject of growth, and this work was continued at Harvard. Always attracted by the study of the nervous system and coming under Dr. Southard's influence at Harvard, the interests of the writer expanded to embrace the complex pathology of the nervous system.

From June to November, 1915, Dr. Edward B. Allen, a graduate of Harvard Medical School, and laboratory interne with Bond in 1913, was assistant physician, devoting about half time to laboratory work.

During 1915 the only alterations in the laboratory were in the nature of necessary repairs. A certain amount of new apparatus was purchased, either to replace worn-out pieces or to augment that already existing. The most important pieces are: a Cooper-Hewitt mercury vapor arc lamp; self-registering (Toledo) balance for organ weights; Fairbanks platform scale for weighing bodies; Bausch & Lomb Minot automatic precision microtome, with special clamp for objects up to 8 by 10 cubic millimeters; a Leitz freezing microtome. In order to give greater protection to the very valuable records of the laboratory, steel filing equipment was purchased.

During Dr. Southard's term, the practice of having students in the laboratory for periods of six weeks or longer was established, and the list of such men is now a long one. This is a practice of considerable value to both students and hospitals. It would be very difficult for a student to find a place to study which would have more material or apparatus for his use. Any problem involving the nervous system could surely find material here.

Beginning in Dr. Worcester's time, and completely established by Dr. Barrett, came the custom of preserving sections from all body organs in both Zenker's fluid and formalin. From these, blocks were embedded in paraffin, and sections mounted on slides and stored, after being studied. For the most part the brains were preserved *in toto* in formalin, small blocks being later taken for sectioning and staining. Over a thousand autopsies have been handled in this complete fashion. Slides, embedded blocks and the original bits of tissue are available in all of these cases.

No less important is the system of autopsy records. Besides the typewritten protocols, which are bound by hundreds, there are the following card indexes: — autopsy by number, autopsy by name, and a complete anatomical diagnosis index, arranged under organs and their lesions. The writer has added a complete decade index (partial before), an index of clinical diagnoses, and an index showing the disposition and condition of all brains.

That the work of the laboratory has been constantly augmented is plainly shown by the following figures. For the fifteen years 1879–1894 there were 405 autopsies. For the decade 1895–1904 (Worcester, Barrett) there were 539, and for the period 1905–14 (Southard, Adler, Bond, Lowrey) there were 615. During the year ending Sept. 30, 1915, there were 99 complete and 1 partial autopsies. The other work of the laboratory — examination of urine, blood, spinal fluid, bacteriology, etc. — has kept pace with this growth. Although the tests are not performed in this laboratory, it should be noted that since May, 1912, the Wassermann test on the blood serum has been routine for all patients admitted. A great amount of routine work is now required.

No institution is complete without a library. At Danvers this has always received the attention it deserves, and to-day it is not only very complete, but, even more surprising for an institution of this type, the library is up-to-date. We have appended, at the end of the introduction, a list of the journals received at the hospital, indicating where the series for each journal begins and ends, if it is not now being received.

This hospital has been particularly fortunate in its superintendents. Drs. Page, Harrington, Mitchell and Kline have all held courageously to a program in which scientific work was granted a prominent place. Hence the laboratory has always shared fairly in the hospital expenditure. To the foresight and practical encouragement of these men the laboratory owes more than can be expressed.

The results of their policy are plainly evident in our well-equipped plant, and in the large amount of work that has come from it. A laboratory or institution is largely judged by its relations with the outside scientific world, rather than by its routine work. The best available index of this relationship lies in the type and character of the papers issued from it. To show this for Danvers State Hospital, we have grouped all of the papers written by members of the staff, or based on Danvers material, at the end of the introduction. This list is as complete as we can make it.

From the list it is fairly evident that Danvers men have been able and prolific writers, and that the laboratory material has been much and wisely used. Many of these men are represented in this volume. To them we express our thanks for their help in making this conference a success. No surer indication of the value of the laboratory in the study of mental disease could be found than in the interest which these contributors have taken in this conference, attempting, as it does, to show the value and importance of laboratory work in hospitals for the insane.

Biographic.

William Leonard Worcester was born at Chelsea, Vt., April 21, 1845. His paternal grandfather was a clergyman; his father, a physician.

Dr. Worcester was the oldest of a family of nine. He was fitted for college at Thetford Academy, Vt. In 1869 he graduated from Dartmouth College, ranking second in his class. In the fall of that year he was appointed clerk of the Senate Commission on Pensions in Washington, D. C. In 1870 he became a clerk in the Pension Bureau, and while holding this position took a medical course at the Columbia Medical College, Washington, obtaining his M.D. in 1873.

He was then appointed a medical examiner in the Pension Bureau. This position he held until 1875, when he went abroad for further medical study, chiefly in Vienna.

Returning to this country in 1876 he engaged in general practice for two years at Burlington, Vt. Having decided to devote himself to mental diseases, he became assistant physician to the Michigan Asylum for the Insane at Kalamazoo, where he remained for eleven years. He then became assistant superintendent and pathologist to the State Asylum at Little Rock, Ark., where he remained for six years.

During these seventeen years he had been making a study of pathology, especially as related to mental disease, and it was his splendid equipment in this line which led to his appointment as assistant physician and pathologist to Danvers in 1895.

His sympathies were large; his interest in patients intense. He was of a calm, philosophic temperament; a lover of justice and truth. He was a close reasoner; a thorough analyst. He had studiously cultivated a gifted mind. He was a naturalist and botanist.

As a psychiatrist, he ranked with the best known of the country. As a pathologist, he was an expert in that branch relating to mental diseases. He was a voluminous writer, and his writings bear the stamp of authority.

He was very modest and not easily approachable. He never married, but devoted himself to his work. On May 31, 1901, while performing an autopsy, he infected a finger. Although everything possible was done for him, he succumbed on June 9, 1901. To the last he was calm and uncomplaining.

Dr. Worcester did much for the Danvers laboratory, more than can be put into words. He was in large part responsible for our present system of staff meetings, and established an adequate laboratory routine. He did photography in a day when it required expert knowledge. Many of the plates he made are still in the laboratory. From some of these it is evident that he was interested in those conditions which we to-day ascribe to polyglandular disorder. His notebooks betoken a keen and thorough analysis of all his cases.

We feel that the contents of this volume will be a fitting memorial to the memory of our first pathologist, — one which he would have appreciated more than any other we might have devised.

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Am. J. Med. Sci.: American Journal of the Medical Sciences.
Am. Med.: American Medicine.
B. M. S. J.: Boston Medical and Surgical Journal.
Centr. f. Bakt.: Centralblatt für Bakteriologie.
Int. Clin.: International Clinics.
J. A. M. A.: Journal of the American Medical Association.
J. Exp. Med.: Journal of Experimental Medicine.
J. Abn. Psych.: Journal of Abnormal Psychology.
J. Med. Res.: Journal of Medical Research.
J. N. M. D.: Journal of Nervous and Mental Diseases.
Med. Rec.: Medical Record.
Rev. N. P.: Review of Neurology and Psychiatry.
Trans. Am. Med-Psych. Assn.: Transactions of the American Medico-Psychological Association.
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PART I.

SYMPOSIUM ON THE VALUE OF THE LABORATORY TO THE HOSPITAL AND STATE SYSTEM, AND ON THE PLACE OF THE STATE HOSPITAL IN THE DEVELOPMENT OF PSYCHIATRY.

PART I.

INTROSPECTS AND PROSPECTS.

By James J. Putnam, M.D.

The period of my brief connection, as pathologist, with the State hospital at Danvers (which town is my hereditary home) marked a bright episode in my life, and I look back on it with great pleasure, disturbed only by the regret that its duration was so short and the work done so little conclusive in its character. I had learned already, partly through my studies in the laboratory of Professor Meynert of Vienna, then with Sir Wm. Gowers, and other pioneer investigators in neurology, to feel a lively interest in the pathological anatomy of the nervous system; and while mindful of Dr. Holmes' characterization of this study as being like looking at the fireworks on the 5th of July, it is an interest which I still retain. I maintained for years a pathological laboratory in my own house, the traces of which still remain. If I had not felt obliged to give the main portion of my leisure to my lectures and to developing the neurological department of the Massachusetts General Hospital, and if, also, several other — mainly internal — conditions could have been fulfilled, which, alas, were not fulfilled, I can imagine that my appointment as pathologist in 1879, by Dr. May, whose bright, eager face I so well remember, would have marked the beginning of a series of labors in the direction in which this admirable hospital has gone so far. As it is, I have always recognized with the greatest satisfaction the excellent and pioneer work that the laboratory department of the hospital has accomplished.

It is also very pleasant to recall that I knew personally that quiet, modest, somewhat awkward and constrained, yet truly remarkable man and scientific worker, Dr. Worcester, and that I learned early to appreciate his fine qualities, the wish to honor which is one of the motives that brings us here to-day. He visited me several times at my house, showed me his microscopic specimens and told me of his researches and gave me the chance to feel the glow of his scientific zeal.

I have, then, every inducement to cry, "Well done," to those who have labored in the laboratory thus far, seeking, through anatomical and physiological studies, observation, experimentation and deduction, to penetrate into the mysteries of the nervous system and to discover the causes of the disorders of the mind, and heartily wish success to those who are to follow them in this field. And I beg leave also to express the hope that other and equally fruitful methods of research, in which equal amounts of genius, talent and industry can be enlisted, will be found as useful in this atmosphere of liberality and progression as they have been found elsewhere. The method which I have especially in mind is one that seeks to deal directly, in the flesh, but in accordance with the teachings of an advanced and relatively new psychology, with the persons who assemble here as patients, and to see in their symptoms a hieroglyphic language in which a psychologic history of remarkable interest is to be read.

It would be criminal to neglect a single atom of the evidence which comes to us through the post-mortem room and the microscope, or through well-considered deductions — such as those of Dr. Southard, for example — based on the sound doctrine that for whatever happens or has happened, or is about to happen in the mind, something must happen or must have happened in the brain.

But, on the other hand, let us consider for a moment what the most is that is reasonably to be hoped for on these lines, and what it is that we may hope to gain on other lines which have been indicated through the genius of trained and scientific pioneers in the psychologic field; and remember that this latter sort of work is so recent that even its literature is familiar but to very few and that its postulations have been viewed largely through a fog of prejudice.

The question is, what possible goals can the scientific-minded psychiatrist hold up to himself as visions which he may seek to realize?

As we find ourselves face to face with any given patient and listen to the story of his symptoms and his life, it is easy to fancy that we are gazing down long vistas and avenues of promise and evolution, and are becoming aware of mysterious bonds that connect him with a far distant — even a prehistoric — past, and that constitute ties between him and society, or, if one will, with the universe in the widest sense. When looking at the matter broadly, as I now wish to do, we might properly consider that there is no difference between the sick person and the well, and may put together, as if in one category, the characteristics which every man shows in his relations to his fellows and toward his own aspirations and temptations and the symptoms of the neuropathic patient.

It is fair to say that every person brings with him into the world tendencies in this or that direction, such as we may denominate as predispositions, but that these predispositions by no means adequately explain the infinitely varying thoughts and acts which characterize his reactions toward the innumerable problems of each hour. Even when the task before us is only to describe the general trends of such a person's character and temperament, and to aid ourselves in imagining how these tendencies, that condense long histories of experience and conflict, came to gain the peculiarities which they show, it is evident that the problem is one for the solution of which we must rely mainly on the direct observation of men living, suffering and struggling in the midst of social difficulties and dangers, and seeking instinctively to emphasize their strength, to prevent the discovery of their weakness, to find surreptitious compensation in yielding to their temptations and more solid compensations in finding their real status as promoters of the public welfare. What brain anatomist or student of glandular physiology and pathology would venture to define the somatic conditions which should determine, for example, the tipping of the emotional balance now in favor of self-indulgence or refined egotism, now against this result, or which would correspond to the ambivalent existence of love and hate struggling for mastery in the darkness of the subconscious life. Yet it is in this whirlpool of conflict, as in the battle trenches of France, that those phenomena are being brought about which, almost unfortunately, we classify as "illness," but which the deeper man of science might better study and describe as evidence of effort and adjustment, more or less satisfactory or unsatisfactory as the case may be.

The brain of the person whose symptoms, that is, whose general or particular symptoms, to the problems of life have been of such a sort as to unfit him for living among men may have had this or that configuration, the origin of which would be lost, perhaps, in a prehistoric past, or traceable, if we had the skill, to influences brought to bear on the germ plasms of his parents. And as a result of these structural peculiarities, the lines on which his character could most easily develop will have been, in measure, predetermined. A relative under or over development of his affective sphere would tend to have this or that result, of his motor sphere this or that other, of his association tracts a third, and so on. And, again, the exact capacity of development of his nerve tissues would encourage or inhibit his development in theoretically specifiable particulars, as the case might be.

I have in mind, in referring to these points, the patient and admirable researches of Dr. Southard and those who have worked on similar lines, in the determination of the relation of brain peculiarities to the mental characteristics and symptoms, all of which we assume to be classifiable in one category.

To go further on these physical lines, one must assume, among these far backward and forward reaching tendencies, peculiarities of the innumerable tissues of the body, the heart, the kidney, the ductless glands, etc. For it is evident that a specific character — I will not say vitiation, for there is no normal standard — of the nutritive fluids of the body is determined in such ways as these, and that by way of this determination the character and temperament of the reactions of the patient or the person must be in part determined. One may, if one will, group together a large portion of these tendencies under the designation "hereditary."

But important as these influences are in determining what the future life of the individual is to be, and splendid as the vision is of the result to be won through careful investigation on these lines, is it not also plain that the information which they give us helps but little toward the specification in detail of another set of facts which we must consider as vitally important? For one thing, the studies such as I have mentioned are largely individualistic in their tendencies.

They might tell us much about one man in the form of direct evidence, but little about his all important relations to his fellow men. To take an illustration of clinical significance, one may no doubt assume that the feeling tone which is likely to be predominant in any person's life is partly determined by such bodily influences as I have cited, or has one deep root in them. One may say this, for example, of the feeling tone which finds its ultimate expression in an attack of melancholia. But no one can have studied the lives of many melancholic patients without becoming aware that there is a strong relationship between the melancholic history of one patient and what we call the neurasthenic history of other members of his family (the tyranny of names is here terrific), or the depressive tendencies developed perhaps in many members of a large community to which he may belong, as, for example, through the influence of the present war.

The point I wish to make is that it would be asking too much to assume that through the gross or microscopic study of the brain or the chemical constitution of the body fluids, we could ever get information that would, even in a remote degree, correspond to our needs with reference to the details of a person's family history and social life. One might, I think, almost as well hope to discover, through accurate and painful study, the history of a bird's flight and the reason for his flying, through the minute investigation of his shadow upon the ground; or, to take a better simile, to discover by looking at a composite photograph the faces of the living men whose likenesses are buried there.

What is the relation (which is no doubt a causal one in both directions) of the brain and the mind? I fully believe that every act, perhaps every thought, makes some impression, slight though it may be, upon the brain structure; and, conversely, that the fact that the brain is of such and such a sort helps to determine what the thoughts will be.

It is not necessary, at this moment, to go more deeply into the question of the mode in which the brain and nervous system are originally formed and subsequently modified, although this is a point on which I have very strong convictions. I will only say, however, what I think every person must admit, that although one may say theoretically that there is a correlation between thought and emotion in the widest sense and brain structure, just as one may say that when one idly tosses a pebble on the ground it modifies the revolution of the earth around its own axis and around the sun, and so, too, the motion of all the heavenly bodies, yet it is important to admit that not in any significant degree the thoughts and emotions which pass in such multitudes through our minds, and form ever-changing complexes beyond the reach of consciousness, are related to recognizable peculiarities of brain structure in such a sense that the most far-seeing enthusiast would not care to assert his ability to pass from the latter to the former

To revert again to the image of the flying bird, the shadow of the wings upon the ground, in which the speed and restlessness and direction of the bird's motion would be theoretically set forth, would be in part determined by whether and where the bird was seeking his prey, or leading his pursuer, or flying to rejoin his mate. But surely between these two series of events no practical relationships would be assertable. All that I am urging is that above our studies into the somatic life, we should develop to the utmost all our means of tracing out a far more picturesque and kaleidoscopic life, the lines of which, as I believe, we can learn to determine, and a knowledge of which, in a given person's case, would, as I believe, place us in an enviable position for the comprehension of his symptoms and his acts. It is of course true that such a person's symptoms and conduct are virtually a composite photograph, like his brain; but the unraveling is easier because the memories which went largely to the creating of the symptom can now be revealed through a skillful method of interpretation that is now at our disposal and can be translated into the fluid medium of speech.

Suppose it to be true, for example, that every individual is to be thought of as struggling upward across the parapets and trenches and barbed wire entanglements of his evolutionary history toward an infinitely far distant future of perfection, towards the universe, in fact, which he virtually carries within himself, as the seed contains the tree. In fact, the infant's life recapitulates in condensed form the outlines of this history. Experience shows and theory sustains the observation that the basis of these struggles, as of all struggles, is desire, — desire which is at first gross, but which gradually becomes purified, both in itself and with reference to its aim; that as these more humanizing desires gradually emerge from the waters of the prehistoric deluge, they assume, first, what I will call a gross form (and it is in this form that the child feels their mastery of him, side by side, no doubt, with the faint gleamings of more spiritual longings); that the child of any given day finds himself born both with social instincts and into a world where the authority of society reigns supreme.

What is the result? Obviously he must recognize, even if without conscious awareness of the fact, the tugging of the grosser cravings to which I have referred; and these will almost surely lead him toward some form of self-indulgence by which his development will be hampered. Or it may be that this craving will take the form of a more or less hostile self-assertion of his own rights over the rights of others.

These desires are certain to be met by inhibiting influences, which take the form of conscience or of habit, both of which become strongly intensified through the imperative requirements of society. Here begins a never-to-be-ended conflict, — a conflict which it will be more difficult for the individual to meet by the fact that a large portion of his desires, and a large portion, too, of the efforts which he makes to overcome them, or to use them as materials for progress, is sure to go on without his conscious knowledge.

Among the many evidences of skill which the human animal displays in meeting his difficulties, the acquisition of the power to turn his gaze away from his troubles plays certainly an enormous part. As one of the chief results of this half-hidden contest, there arise symptoms which we, as psychiatrists, are called upon to study, and all the varied characteristics of the personal make-up for which "symptoms" is only another name. I think it cannot be too much insisted on that in the study of these symptoms the investigator should set aside the idea that they are the signs of something coming to the patient from without, a parasitic disease in some metaphysical sense, with which a person is afflicted and from which he might conceivably escape; and that instead of this we should recognize in them the indications of a real, even if abortive, attempt to reach some equilibrium of value. Take the symptom called depression, for example. Whatever may be said of its relation to the circulation of certain poisons in the blood, I think no one can have carefully studied its psychological significance without having become aware that it is also a means through which a patient tries, let us say, either to obtain the pity of others, or his own pity, or to find in a species of engrossing self-abasement the equivalent of the glorification of himself which he would have preferred to enjoy in other forms, had this been possible. Every man, especially every man who is neurotic, exhibits throughout his life a strong tendency to fall back from the plane of his more sublimated desires toward that of his grosser and more primitive desires; but this tendency is forever working in more and more subtle forms, and the able investigator and helpful physician is he who can see these latter desires beneath the mask of their manifold disguises.

I will not maintain that fear and a sense of despondency are never in some measure primary states, existing in their own right. It is certain, however, that they have a root in some desire. Every one is aware that to the imaginative child who loves to gaze into the mysteries of the dark room and run away from imagined terrors hidden there to the engrossing shelter of his mother's arms, fear and desire go hand in hand. It is hard to believe this of the suffering patient, or to admit that the terrible sense of inferiority or suspiciousness or morbid apprehension has likewise an origin of this sort. The relationship has now so often been demonstrated as a fact that the accuracy of the statement is, in my opinion, no longer open to doubt. Even the periodicity of the outbreaks of manic-depressive insanity may find at least a partial parody in the recurrent longings for excitement (that is, for reversion to a lower type of thinking), which is so well recognized as explaining the periodic outbreaks of the school boy and the college student.

It would be easy to go further on these lines. What I am attempting, however, is not to present a complete psychology of the psychoses, but to indicate that they have a psychology which is worthy of being studied by experts, with intense care.

In psycho-analysis we have given to us an important means for such a study. I am not now urging that those who learn to use this method should accept as valid the conclusions of those who have already used it. My desire is simply that this hospital should aim for the same sort of eminence in psychological fields that is one of the glories of the Bürg-Hölzli Hospital at Zürich. In this field lies, in my opinion, the best hope for psychiatry — the study of a highly interesting attempt on the part of men and women whom we call patients to obtain a practical solution of the complex phenomena of life. If, with keen psychologic insight, we who have the chance to do so cease to regard these attempts as failure but look at them more broadly, we may find in them the key to many a so-called normal life.

In saying this I have really said all that is necessary. But knowing as I do how unpopular the psycho-analytic method really is, and recognizing that this unpopularity has arisen not from a conscientious employment of the method but from dread of being identified with other men and their results, I cannot avoid the temptation to say a few more words which will throw a little side light on these results, without attempting directly to defend them.

It is not every one who is aware to what an extent the psycho-analytic method has the endorsement of many persons who would never dream of consciously endorsing it. Take, for example, two or three of the great students of psycho-analysis among literary men. Where could one find a better illustration of the hysterical-conversion theory of Freud than in the marvellous picture of Lady Macbeth trying to wash the sin from her soul by washing from her hands the stains of blood of which they were innocent? Or where find a more striking illustration of a hidden, or, so to speak, unconscious thought expressing itself in acts, though verbally denied, than in the marvellous scene in which Henry V, sitting by the bedside of his father, tries on the crown of the dying king?

It is hardly necessary to do more in this connection than to refer to the deep-going psychological analyses of Ibsen, perhaps the greatest of the modern dramatists of the soul, or to mention Dante, Goethe and Emerson.

It is well known, I presume, that the history of mythology is filled with symbolisms such as many physicians find so obnoxious in psycho-analysis; but it is less well known, perhaps, that sober and serious mathematicians have described at length the sex significance of mathematical fancies and habits of thought of ages past. Nor are most people aware, perhaps, of the extent to which our language has its roots in this same deep-lying instinct; or of the fact that the most thorough writer on the subject of childhood and the genesis of its characters, Von Hug-Hellmuth, has based her conclusions very largely on the testimony of child students who had written before the days of Freud.

I could wander on indefinitely in this direction, but enough has perhaps been said to make it clear that in utilizing the psycho-analytic method the physicians of this hospital would be co-operating not with the adherents of a "rapidly diminishing cult," as one of our eminent neurologists has recently termed this movement, but with the thinkers and writers of all time, whose work needs only to be carried out in a scientific sense in order that both its value and the value of the newer scientific discoveries may both receive support.

I could cite also, on the whole, as supporting this commendation of psychology the work done by so many non-psycho-analytic psychologists, both in America and abroad. But this is unnecessary, for, indeed, I feel sure when once external conditions make it possible psychologic work will supplement in this fine hospital the work of the pathologist.

THE PLACE OF THE STATE HOSPITAL AND ITS LABORATORY IN THE DEVELOPMENT OF PSYCHIATRY.

By Sanger Brown, M.D.

In any Commonwealth the general proposition could probably be maintained that each and every one of its institutions should be operated in accordance with the wishes of a majority of its voters. And though it be admitted that, in many instances, a large percentage of the citizens are for various reasons certainly not well qualified to discuss intelligently and comprehensively the scope, limitation and details which should obtain in the operation of their State institutions, to the end that society may derive from them the maximum benefit, yet no less through their representatives variously selected it is their prerogative to voice their acquiescence, approval or protest.

Therefore members of the board having control of all State hospitals in a Commonwealth and likewise the chief executive officers of individual institutions should give the most careful consideration to the attitude which the public shall entertain toward its hospitals; they should seek by judicious educative measures to mold and direct this in the line of progress, and above all, by the exercise of due caution, patience and self-restraint, to anticipate widespread antagonism or hostility.

No doubt the predominating idea in the public mind which in the first place prompted the provision of institutions for the care of the insane was one of public safety; later, to this was added the comfort and welfare of the afflicted; and, finally, the cure of the patient. The evolution of public enlightenment regarding insanity is mainly due to the unselfish devotion of members of the medical profession to the subject, and the stages of progress in the direction of a more comprehensive view is fairly well reflected in the terms mad house, asylum for the insane, and hospital for the insane, in the order named.

Always recognizing the rightful authority of the citizens of a State to determine and regulate the policy and procedures of their own institutions, it is certainly proper and pertinent for those who have largely devoted their lives to the study of the subject, and who at the same time have had the most favorable opportunity for practical observation, to discuss the relative importance of the various kinds of service which they render or may render, to the end that existing efficiency and public confidence may remain unimpaired and sound lines of progress marked out.

If it be assumed that the rational treatment of disease, based on a correct understanding of its cause or causes, whether the measures adopted be preventive, curative or palliative, is properly the cardinal purpose of medical science, then to develop and extend to the citizens of a State the most efficient treatment of insanity should be the cardinal purpose of the State hospital and its accessories. This implies that each patient should receive competent medical attention while under the care of the institution, and that a fair medical history of his case be duly recorded. Now in my opinion this history comprises the most direct contribution which the State hospital can make to the development of psychiatry, and the question at issue is, How much of the State funds should be appropriated for the elaboration of the aforesaid history? This must be determined from time to time by the voice of public sentiment expressed through the State Legislature.

Progress in the development of any department of science depends largely upon well-directed research work. This is often expensive and in the end barren of practical positive result; and furthermore, in psychiatry, it sometimes requires the patient to submit to procedures which are more or less repugnant to the sensibilities of his family and cannot be held to promote immediately either his cure or comfort. It should be stated in this connection, however, that under no circumstances, in any kind of research work properly conducted, is anything done that might in the slightest degree impair the patient's prospect of recovery or sensibly interrupt or reduce his comfort, the natural and commendable solicitude of sympathetic relatives notwithstanding. It cannot be fairly maintained that original investigation thus far has achieved such success in its ultimate aim, — demonstration of the essential cause or causes of insanity, — as to afford society any relief from the burden imposed upon it by this sad affliction. Whatever improvement has been made in the treatment of the disease, and which is manifested by the various measures taken to contribute to the patient's comfort and recovery, has resulted from an extended understanding of its phenomena together with a more generous expenditure in meeting the indications presented.

Notwithstanding, however, all objections that have been or may be raised, the problem of discovering and demonstrating, so far as may be, the essential cause or causes of insanity demands and is worthy of the highest forces and faculties our race can supply. The march of progress toward the solution of this problem undoubtedly lies in the direction of original investigation or research work, and to carry this on properly in the State service considerable funds and the co-ordinated effort of State hospitals are indispensable.

An institution devoted primarily to original investigation, critical examination of methods, and procedures either established by usage or newly proposed, execution of processes demanding the employment of highly elaborate technique, and arrangement and presentation of the work done so as to make it so far as may be available for the improvement of hospital practice, requires for its highest efficiency an organization and equipment quite different from that of the hospital, although each establishment has the same ultimate object. While the work of each should be conducted under independent management in order that the best results may be obtained from both, a bond of intimate co-operation between them is indispensable. Whatever contribution the State may make to the development of psychiatry must be supplied by the united efforts of these two institutions. The psychopathic or psychiatric institute constitutes the logical "forward step" in the development of psychiatry in well-organized State service. Every State should maintain or aim to maintain one.

SUMMARY.

The place of the State hospital and its laboratory in the development of psychiatry is —

1. To maintain such a policy of operation as shall win and deserve public confidence and approval.

2. To embrace every seasonable opportunity to disseminate sound views among the laity on the subject of psychiatry.

3. Without impairing their utility to the hospital, to so elaborate its medical histories as to make them of most value to the psychopathic or psychiatric institute in the prosecution of its proper work.

EDUCATIONAL VALUE OF STATE HOSPITAL LABORATORIES.

By Chas. W. Page, M.D.

When the current of events in a man's career has obtained decided momentum, or the march of progress in a conspicuous enterprise has reached a point of special vantage, it is interesting and profitable usually to institute a comprehensive survey of the things accomplished.

On such grounds the present seems to be a suitable occasion for those who have been identified with the past history of the Danvers State Hospital to review the inception and the development of the hospital laboratory, to verify the accumulating observations as to its productiveness, and to contemplate future activities with clarified ideals and renewed enthusiasm.

A regard for scientific medicine has characterized the management of this hospital from its earliest operations.

In the second year of its history the pathology of selected cases was made the subject of special investigation, as minute and searching as the meager laboratory facilities of those days permitted.

Dr. James J. Putnam, the pioneer pathologist of Danvers State Hospital, was a non-resident official, and must have worked under serious disadvantages, as the basement room set apart for scientific operations in pathology was obscurely located, difficult of access, and almost devoid of special apparatus.

Yet Dr. Putnam made the most of his opportunities and retained official relations with the hospital for five or six years, enjoying at all times the hearty co-operation of the medical staff and the support of the trustees.

In those days the scientific basis of medicine was being developed rapidly, and year by year the hospital authorities became increasingly anxious that Danvers should rank with the foremost institutions, and recognized the pressing necessity for more adequate quarters and more suitable apparatus for chemical and pathological work.

However, nothing in that line was provided until the year 1890, when about one-third of the space which now comprises the laboratory was roofed over and walled off into three compartments, thus providing limited arrangements for morgue, pathological and chemical purposes.

Apparatus and supplies were provided as called for, and members of the medical staff were urged to use them freely, not alone to settle questions of diagnosis, but in experimental and research work.

Dr. Harrington, than an assistant physician, was detailed to pursue a special course in bacteriology at the Harvard Medical School, in order that hospital patients might receive all possible benefit from advancing knowledge in that branch of medical science.

Subsequently, another assistant physician, while engaged in clinical ward work, made an extended study of uric acid excretion, tabulating his findings, and correlating variations with changing clinical symptoms, thus producing an interesting paper for a medical journal.

Likewise another clinical assistant undertook a methodical study of blood conditions as found in certain of his ward patients. His paper, explanatory of these laboratory observations, was published under the title "The Diagnostic Value of Blood Examinations."

Meanwhile, this modest, provisional laboratory was utilized for a limited amount of post-mortem and pathological work; but the more exacting clinical service greatly increased its use for chemical determinations.

Thus may be condensed a fair account of operations along this line of hospital work down to the year 1895, which date certainly marked for this institution an epoch that richly merits the formal recognition which this day's reunion is intended to celebrate.

That year the present commodious laboratory was constructed, and Dr. Worcester was secured to conduct its operations.

The ideal laboratory had been a constantly expanding conception. As the scope of its possible service in the fields of clinical medicine, pathological investigation and morbid psychology was gradually comprehended, the pressing necessity for enlarged floor space, better isolation of departments, and perfected fixtures became evident.

For a number of years a plan for a congregate dining room had been under contemplation, and when in 1895 the definite scheme for the present arrangement was submitted to the trustees, the suggested addition embodied a design for an enlarged and improved laboratory, substantially as it stands to-day.

It had been foreseen that efficient laboratory service could be secured only when directed by a specially trained, competent pathologist; therefore when Dr. Cowles recommended Dr. William L. Worcester for this position, his appointment speedily followed.

The distinctive title accorded him was "assistant physician and pathologist," and his qualifications to fill both offices were of the highest order.

Dr. Worcester, then of middle age, was a man to be honored for his intellectual endowment, his humane prompting, his inflexible integrity, his industrious habits, and his scientific attainments. Always a diligent student, he had a wide knowledge of existing literature upon insanity; by practical experience in hospital wards extending over years of actual service in clinical work, he had become conversant with all phases of mental disease. Then, by prolonged and critical study of cerebral pathology, he had become an acknowledged expert in that promising field of research.

For months after his appointment Dr. Worcester was unable to prosecute systematic pathological examinations owing to the unfinished condition of the amplified laboratory; and yet before the 1896 annual report was issued, he had made thirty-six autopsies where, with a few exceptions, the brain had been subjected to a microscopical study of its substance. Histological examinations of other diseased organs were undertaken where interesting results could be anticipated.

Besides, for months he had substituted in clinical ward work for absent or sick members of the medical staff; and in addition to the work thus outlined, he had written several interesting scientific papers. In giving an account of his first year's work, his statement reads as follows:

> The systematic examination of urine with reference to the connection between renal disease and insanity, begun last year, has continued. Apart from my services on the lower floor of the female department, I have made frequent visits to the wards, have examined and made notes of cases of special interest, photographed patients and pathological specimens, examined blood and sputum microscopically, and in general have endeavored, to the best of my ability, to contribute to the study of the various morbid conditions found among our patients during life, as well as after death.

This instinctively modest man, with his large experience, ripened judgment and practical genius, was a valuable acquisition to the official staff of the hospital. Willing at all times to counsel and aid others in clinical difficulties, anxious to demonstrate, where possible, the significant connection between mental and accompanying physical disorders, his medical associates were strengthened for their daily tasks and encouraged in their study of psychiatry.

In all his work, Dr. Worcester's main consideration was accuracy, — accuracy of observation, accuracy of interpretation, and accuracy of description.

This ruling principle is transparent through his work and records; hence his successors have found them valuable for reference, for comparison and for summation.

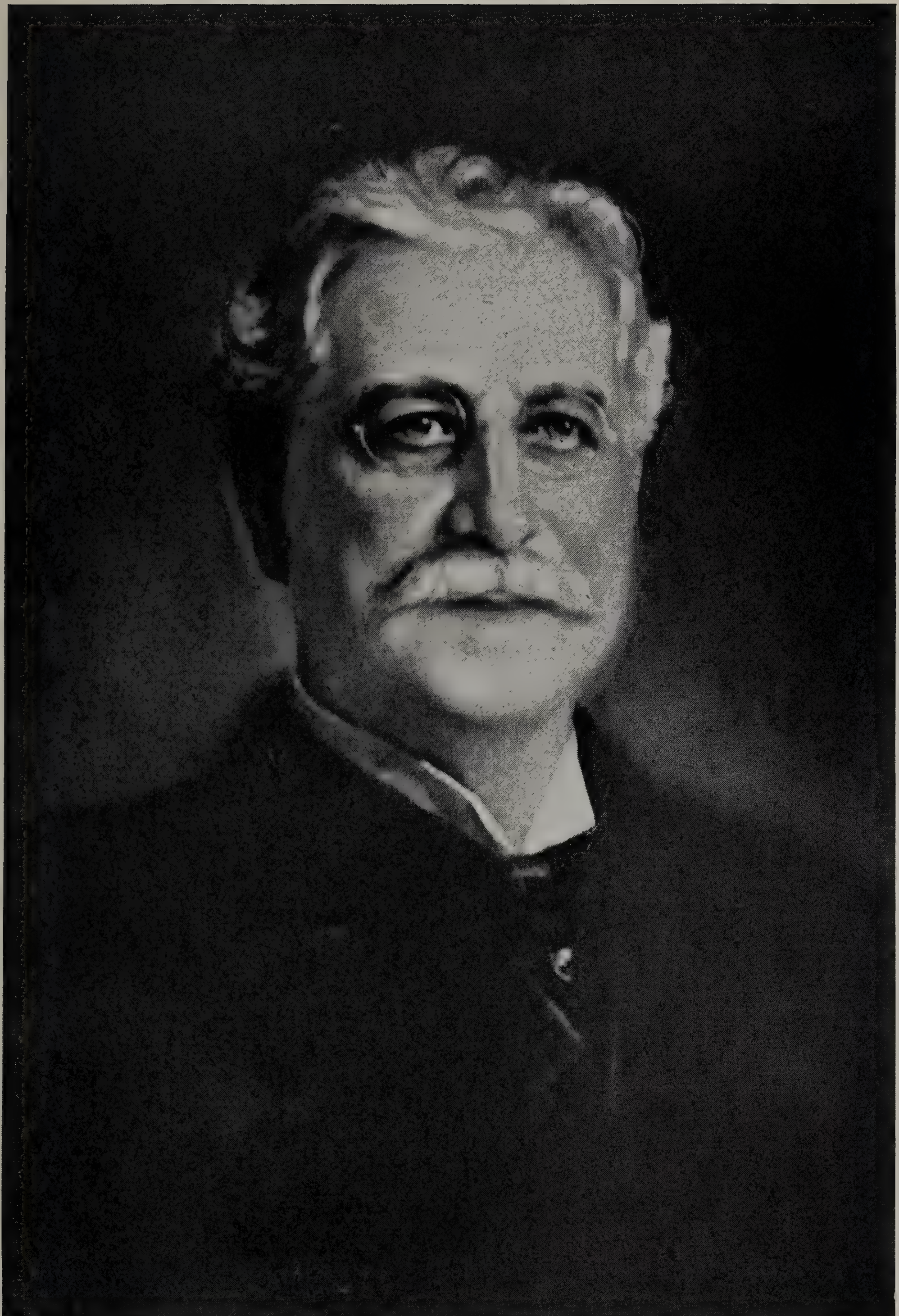
After such ideals and along such lines of devotion Dr. Worcester wrought successfully in this institution for nearly six years, when his invaluable services were ended by death.

By great good fortune Dr. Worcester was chosen to establish the province of the hospital pathologist in this institution. His general conceptions of the office and his achievements in that capacity were remarkable for comprehensiveness and for efficiency.

Fully realizing the import of such a declaration it is especially gratifying to be able at this time to add that his successors have maintained the high standards which Dr. Worcester inaugurated. Furthermore, under the aggressive initiative of succeeding pathologists, the development of the State hospital laboratory has been masterful. The hospital management, medical officers, trustees, and especially the medical representatives on the Board, were deeply interested in the work, liberally disposed towards its support, and quite optimistic. New men have been put in charge as vacancies have occurred, the working force has been increased, and the resulting outcome has surpassed early expectations.

Only occasionally did Dr. Worcester have help in the laboratory; but soon after Dr. Barrett succeeded him it became evident that a pathologist's time was too valuable in clinical and experimental work to be spent in routine bench work which a properly trained clerk could perform, consequently a laboratory assistant was permanently employed.

In Dr. Worcester's day staff meetings to consider the clinical symptoms of selected cases had been frequently held in the wards, but now was established the daily staff meeting in the library to review in turn the history and provisional diagnosis of each newly admitted patient, and at such meetings the pathologist took a prominent part. Then the occasional staff meeting in the laboratory became more interesting and profitable when



Charles W. Page, M.D.

Superintendent, 1888–1898, 1903–1910.

in Dr. Barrett's time the desultory method of viewing preparations under the microscope, by members of the staff in rotation, was rendered obsolete by the installation of a projection apparatus, which permitted a rapid demonstration, before the whole staff, of pathological conditions found in each deceased patient.

With constantly improving laboratory facilities workers in special lines of research were attracted. One of the clinical assistants became so engrossed in a bacteriological problem that he labored there exclusively for nearly two years.

Among other voluntary workers in this department was Dr. Southard, who eventually succeeded Dr. Barrett when he resigned, in 1905, to become director of the Michigan Psychopathic Hospital.

Dr. Barrett, by his energetic application to the service, had secured gratifying results, and had reconfirmed the judgment of the management that a properly equipped and skillfully conducted laboratory is of the greatest importance, — a necessity even, — to a large hospital for the insane.

Before Dr. Southard came to Danvers he had established for himself an enviable reputation as a neuropathologist, and his familiarity with laboratory methods in the Harvard Medical School had disclosed to him the secret for accelerating action in the State hospital laboratory.

Additional apparatus was introduced and working facilities were otherwise perfected. Then the force of assistants and collaborators was augmented. An expert bacteriologist was added to the staff. Two graduate women physicians became permanent laboratory assistants. They developed exceptional proficiency in microscopical, bacteriological and chemical work, and eventually added their quota to the literature which pertains to the field of their labors.

Outside professional students, engaged in special lines of research, were permitted free use of the laboratory. Some members of the clinical staff engaged in practical laboratory work in order to establish a scientific basis for the papers they were writing.

Under the combined efforts of such an organization various problems, covering a wide field of practical medicine, were considered.

Many satisfactory conclusions were reached, while pathological specimens, laboratory products and valuable records (all carefully indexed) rapidly accumulated, and thus have become a permanent wealth of material, still concealing, no doubt, many important scientific secrets which safely await further efforts at extraction.

It is hard to resist a temptation to trace the further growth of this most fruitful laboratory under the able direction of Dr. Adler and his successors in its management; indeed it would be a matter of deep personal satisfaction to announce the names of all the talented and devoted workers in this laboratory, — those who through conscientious endeavor, and often brilliant achievements, have obtained a recognized standing in the professional world, and thereby conferring credit upon the Danvers State Hospital. But the list is long, and its incorporation in this address could not add to the reputation and distinction which the well informed in such matters have already accorded the greater number of those comprised in that roll of honor; besides, the especial object of this reminiscence is not to eulogize the living, but to proclaim the educational value of the State hospital laboratory.

It would be impossible to compute the extraordinary amount of scientific and practical knowledge which has been acquired through the work of that department of this institution by those concerned in its past operations.

The tempting opportunities for high-class, professional work afforded by the perfected laboratory have stimulated the aims and increased the ambitions of the greater number of students and physicians connected with this institution for the past twenty years. It may fairly be claimed that some measure of the professional success which they have achieved already is due to the incentive received from, and the privileges enjoyed in, this modern laboratory.

Then the profession at large is also indebted to this department for the many scientific facts of medical interest which have been demonstrated here only to be imparted to those interested and the public through reports, lectures and published papers.

Dr. Putnam in his 1880 report wrote as follows: —

> Whenever the clinical history of any case taken together with the results of the post-mortem examination offer enough of interest, they both will be published. Already specimens have been repeatedly exhibited before the medical societies and practitioners, and the usefulness of this department promises to be great.

We believe that prediction has been and is being fulfilled.

The liberal, ethical procedure exhibited by Dr. Putnam has prevailed with his successors in this department, and in various ways they have continued to share with others the fruits of their investigation and the practical conclusions they have evolved. An index of all their laboratory and literary work would be impossible here and now, but a suggestion of the magnitude of such educational labors may be found in the annual report for 1908, which gives the title of twenty papers printed within the hospital year, and nineteen of those were based wholly, or in part, upon laboratory experience and findings.

During the same period of time several book reviews, written in this hospital, appeared in journals, and twelve other papers were being worked up for publication by the medical and laboratory staff.

Laboratory work, such as represented by those papers, is exceedingly important.

In large hospitals for the insane expert laboratory operations are absolutely necessary if the patients are to receive the best possible treatment, and if epidemics, from contagion or infection, are to be suppressed or skillfully controlled. Yet the predominant function of the State hospital laboratory is probably to educate the public.

Certainly these laboratories provide the measures through which the underlying causes of insanity can be accurately determined, and undoubtedly they constitute the most efficient agency for promulgating knowledge concerning insanity, pointing out to those interested its physical bases, what leads to its development, and how man can escape this serious calamity.

A great future for the laboratory looms before those who entertain such views and hopes.

While many of the agencies which produce insanity, — the indirect, the exciting and the predisposing causes, — have been settled beyond dispute, important problems remain unsettled, though it is a reasonable expectation that diligent search for the subtle causes responsible for acute mental disorder will be ultimately rewarded.

However that may be, many things which lead to insanity are sufficiently well understood now to warrant the conviction that the most effectual remedy for insanity is prevention; and yet machinery for action on that line of attack cannot be assembled before the startling truths about insanity and the possibility of suppression have become a vital part of common knowledge.

A clear conception of the relationship between cause and effect in the outbreak and development of insanity, and the obvious lessons to be drawn therefrom, will advance but slowly in the public consciousness.

We can be reasonably certain of this, for while the more intelligent ranks of society have for a long period held rational views of insanity, and the advanced ideas have been taught in all the schools, still the majority of men have seen scarcely anything but mystery and fate in its manifestations. Then in all countries there remain multitudes who continue to misjudge evidence of insanity through ignorance and superstition.

The hospital laboratory is the source and center from which knowledge and commonsense on this subject must emanate; and because all the people are divided into comparatively small hospital units, laboratory instructions can best reach them.

Pathological experts and hospital physicians must demonstrate the fundamental conditions, formulate practical conclusions, and pass the potent ideas along until they have moved all grades of society. For this object every avenue for transmission should be appropriated. The essential points should be discreetly communicated to patients, and instilled into the minds of the patient's friends and relatives. They should be disseminated by medical teachers and medical practitioners, and circulated through the medical press, the newspapers and other forms of popular literature.

In this grand crusade the management of each hospital should understand its duty and courageously discharge its responsibility. What if settled questions are occasionally reconsidered, and inevitable conclusions are reaffirmed, the lamentable increase of insanity and the causes therefor will have to be iterated and reiterated over and again before public sentiment crystallizes into prohibitory moral suasion and legal enactment.

Forty or more years ago a few public-spirited physicians were predicting grand results in suppressing common diseases through State preventive medicine, but for years subsequently the mass of the people took little interest in this revolutionary movement. To-day every one can appreciate the brilliant successes which have followed the more and more efficient work of State boards of health; and yet practical efforts to anticipate and prevent insanity have scarcely been attempted, although it has been pointed out by acknowledged authorities that at least one-half of this blighting malady results from intemperance, vice, and the prolific reproduction of the obviously defective members of society.

When this avoidable burden of personal misery and the frightful cost of it all becomes thoroughly appreciated by the people at large, a sweeping wave of moral and social reform will undertake the prevention of insanity.

APPLIED PSYCHIATRY IN STATE CARE OF THE INSANE.

By Arthur H. Harrington, M.D.

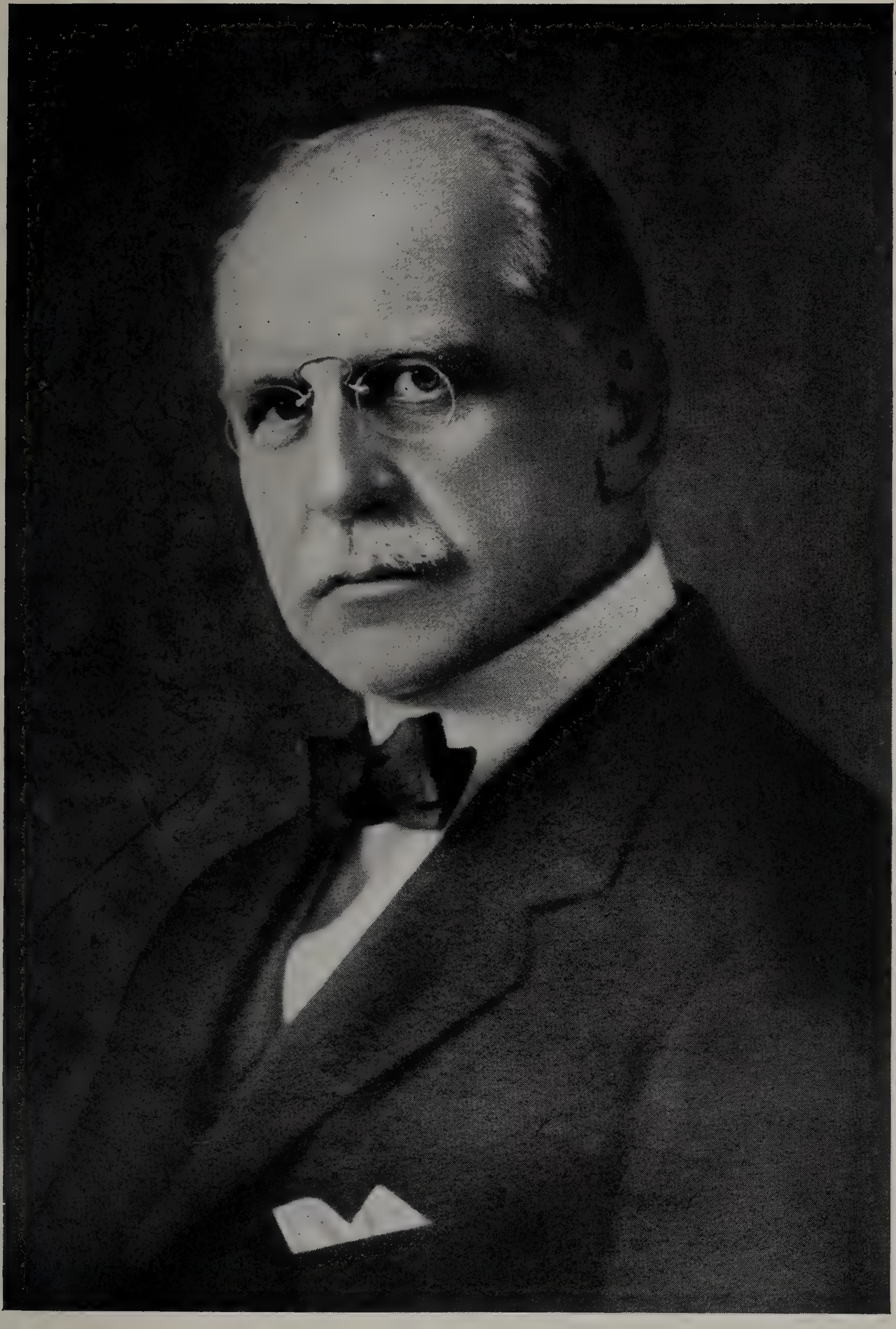
Fifteen years ago Wernicke remarked that psychiatry was at that time a century behind all other branches of medicine. While at the present moment psychiatry presents vastly redeeming features as compared with even a quarter of a century ago, so decided in some respects have advances been within that time, yet I think we must admit that it is still further from achievement as a science and an art than some other world recognized specialties of medicine.

Considering that from the force of circumstances the alienist was the first specialist in point of time, and preceded by a long period the advent of those who began the development of specialization in other fields of medicine, nearly all of which have yielded result, both conspicuous and rich, it has by way of comparison often been assumed that the alienist was culpable on account of the slow advance in mental medicine, and he has frequently been reproached on these grounds.

I believe that psychiatrists and those who have been engaged in the practical application of psychiatry in the actual care of the insane have recognized their position for years in relation to the retardation of their specialty, but I doubt if all the adverse elements which have entered into the situation are comprehended on every hand, especially by those who have been disposed to criticize.

Every one realizes that the approaches to the investigation of mental phenomena, whether in the field of psychology or psychopathy, are beset with innate and subtle difficulties with which deep students have contended for centuries. Thus the native obstacles to the advance of psychiatry have been far more formidable than those which have opposed progress in the entire remaining field of medicine. But there have been other restraints placed upon the constructing of a science of psychiatry and its practical application for dealing, with complete satisfaction, with insanity as a social problem than those imposed by the natural order of the universe.

The long ages of superstition and in consequence the baneful attitude of the multitude, which extended into a generation not



Arthur H. Harrington, M.D.
Assistant Physician, 1885–1894.
Superintendent, 1898–1903.

BAT

so very remote from our own, effectually obscured the glimmerings of truth and paralyzed effort to acquire enlightenment as to the rational explanation for diseases of the mind.

Then we come to the period of philanthropy, frequently so called, initiated by a public conscience, aroused at last to a realization of the long neglect of the insane. Like nearly every philanthropic movement this one directed to the cause of the insane received its first support from private and corporate means. As instances we have seen the founding of many admirable private institutions, which have been to the mentally afflicted a noble charity, and here and there one has coupled with its charitable purpose an opportunity for scientific work in the field of psychiatry. But we have never as yet witnessed, as some other human interests have, an organized foundation of munificent and enduring proportions for the prosecution of scientific investigation, research and experiment into a class of diseases, which we call mental, which do not attack members of the human race by epidemics, but which are always present; which have distressed mankind since history began and which with the growth of civilization have increased their human toll, from which no individual, however secure he may feel, can set up a claim of future immunity.

Following the ushering in of the so-called period of philanthropy, and applying what I have to say here to our own country as a whole, as society became more complex, as immigration added its millions to our growing native population, the rising tide of the dependent insane became too great for private means and for local authorities to cope with, and here the State stepped in to assume entire control of the problem.

In a number of Commonwealths the funds of public treasuries were for a time, especially between the years 1850 and 1880, freely poured out for the creation of massive congregate structures for the housing of the insane, and in some instances at an excessive cost, authorized, however, by Legislatures because a wave of popular support prevailed at that time, founded no doubt to some extent in the mind of the general public on the humanitarian aspect, but to the many pride in these architectural creations was a moving sentiment which furnished approval. While writing this article I came across this same thought expressed by John S. Pardee in the "Outlook" for November 10 of this year, in which he says: "When they drove visitors out to see the institution, they wished to point with pride. With that patriotic purpose delegations of citizens waited on the Legislature at each session to clamor for a new wing for the administration building. It was the member who brought home most bricks and mortar who was met at the station by the band playing 'Conquering Hero.'" Tradespeople also had a feeling of self-congratulation in the vision of increased opportunities for business which these large institutions with their annual budgets seemed to promise.

What we may say about this period is that there has been evolved from its experiences a vast amount of knowledge which is valuable in relation to construction; physical care of the patient has been greatly improved; the principal of custodial care has been much modified by the abolition of restraints and the introduction of greater freedom for patients. We have learned that occupation gives us quiet and orderly wards in place of noise and destructiveness. While this was a splendid developmental period in most material aspects, yet no great encouragement was given to the scientific study of mental disease. I well remember that in 1884 when the late Dr. William B. Goldsmith returned from a year of absence, spent in the hospitals and laboratories of Europe, he was imbued with the thought that this hospital should have a resident pathologist, but the time was not ripe for such addition to the staff, and eleven years, with the consequent loss of valuable material for study, had to supervene before the vision entertained by Goldsmith could be realized by his successors.

While what I am about to say has not been true of every State, yet with rapid increase in numbers of the dependent insane, and the growing burden of their support which this generation has witnessed, it is generally true that appropriations for this class have been limited to what have appeared to legislative committees to be what actual necessity and bare expediency required. Naturally the development of the scientific side of the care of the insane has not made its appeal to them and has suffered in consequence. The scientific equipment of a hospital has appeared to them a luxury. I have even known the matter of the proper keeping of case records to be met in this wise. A State official, on being shown the hospital record of the critical physical and mental examination of a patient, remarked, "Doctor, do you cure any more cases since you began to have these records made?"

In the annual cost of the maintenance of the dependent insane, which for the whole country is estimated at not far from $40,000,000, is to be found, I believe, the reason for a comparatively new experiment in the government of public institutions, and that is the substitution of paid boards of control to carry out central administration of these institutions in place of non-paid local boards of trustees. This system has been adopted by no less then eighteen States already, and there are movements for a like change in a number of other States.

No one could reasonably object to this method if it could be demonstrated that it is a better form of administration than any yet devised. When we say better, we must apply the comparison to all the features which enter into the situation, not only the economical and material, but the humanitarian and the scientific. The question which arises is, how does this new system correlate all of these features?

Dr. Thomas W. Salmon has published some observations based on certain data which he has obtained from certain States in which central paid boards are in control. He finds that in Illinois there has been a serious retrogression in the care of the insane; that Ohio is backward in the care of the insane; that in Wisconsin there is failure to appreciate the scientific and humanitarian phases of the care of the insane; that in Iowa 17 per cent. of the insane persons were in county almshouses practically without facilities for treatment and diagnosis; that in the State of Washington the care of the insane is openly regarded as a perfectly legitimate field for practical politics; that in West Virginia, as the result of a report upon the care of the insane made by Dr. Carlos F. MacDonald, at the request of the Governor, steps are being taken to remove the care of the insane from the board.

Coming nearer home we know that recently in the State of New Hampshire, through intrigue, the board of control, without a plausible charge to stand upon, deposed the superintendent of the New Hampshire State Hospital, an honored member of our profession, who had filled with distinguished success and with entire satisfaction to the people of the State his position for many years. In this instance popular indignation was aroused throughout the State by this act and Dr. Bancroft was, as we know, shortly reinstated.

In the State of Rhode Island a plan is being carried out which should also be characterized as an experiment. By this plan the State Hospital for the Insane is being administered by two boards: one being the Board of State Charities and Corrections, which is non-paid; the other is the Board of Control and Supply, the members of which are salaried. This system has brought about confusion detrimental to the State Hospital for the Insane, as well as to other institutions of the State. The Rhode Island Medical Society and other organizations, medical and non-medical, have passed resolutions advocating the creation of a non-paid board to administer the State Hospital for the Insane and the School for the Feeble-minded. Dr. Salmon says: —

> Under boards of control politics influence the care of the sick to a degree unknown under different types of supervision, and the scientific and humanitarian aspects of the work undertaken are generally subordinated to doubtful administrative advantage.

I believe that if we look the country through we shall discover that where we find the highest degree of clinical excellence and associated laboratory interpretations and research in skillful hands that there we shall find an absence of political control and the presence of interested and painstaking non-paid local boards of trustees. Central boards of control with power over the internal administration of institutions, an attribute which they jealously guard, and carrying this out at arm's length, as it were, tend to rigidity and a limited appreciation of the scientific phase of the care of the insane.

The system which has stood the test of time is that which leaves the superintendent in control of the internal affairs of the institution and in which close touch is maintained with a sympathetic board of local trustees. I would add to this a supervising State board, the functions of which are advisory and which look to a wise co-ordination of all the interests which enter into State-wide care of the insane. Such a system, I believe, besides insuring economic administration, is the best guarantee of proper standards of care, guards the humane interests of every individual who is brought into relationship with State care, and offers the greatest encouragement to the scientific development of our work.

I have cited the foregoing in order to present some of the vicissitudes which have attended the development of psychiatry and its practical application in this country. Whatever measure of truth we are ready to admit lies in Wernicke's dictum, referred to at the opening of this paper, it is these various vicissitudes, in one form or another, which are largely accountable for his charge, and it is well for us to comprehend that we are exposed to certain of these vicissitudes this very day.

Yet at the present moment the whole situation is susceptible of further analysis. If we stop to reflect, our attention will be drawn to the fact that in our organization of State care of the insane everywhere, comparatively few individuals have an active part in the establishment of the policies of the State in regard to the public care of this class. They are legislative committees on charities and finance; the Governor of a State; a few officials holding State positions, whose duties directly or indirectly bring them in contact with the business of the institution; boards of trustees; boards of control; visiting committees; official employees of the hospitals; a small minority of the general medical profession; and persons in the community, — a few through philanthropy and the remainder having had insanity brought to their very doors in the person of a relative or acquaintance. In other words the mass of the people have little interest in the insane and ask for no voice in dictating the policies of the State towards them. There is no other field of medicine, however, towards which the people have this attitude. In fact the people to-day are keen in their information on general medical and surgical matters. The success which attends the treatment of appendicitis to-day is due to the knowledge of the disease held by the general public, which knowledge favors submission to early operation. The education of the public in regard to tuberculosis has resulted in a general demand for State sanatoria for the treatment of that disease.

Now while the actual care of the insane will always have to be monopolized by the few, what we need behind that few is a public educated as to the requirements of State care of the insane. When we have the public interest aroused in the insane to the extent that it appeals to the whole public, when the legislator feels that the whole community is demanding the highest standards of humane and scientific treatment for mental disease, then what I have called the vicissitudes of psychiatry will have largely disappeared.

In order to bring about the interest of the public and to educate them in our branch of medicine, as they have been informed in general medicine and surgery, we must bring the results of the scientific work and practice of our specialty before the people in such a way that they will come to have some degree of knowledge of the natural history of mental diseases; how they may possibly be averted; if developed, what measures the State is ready to provide for treatment and care; the relationship between certain social conditions and insanity. In other words, our appeal must be made through applied psychiatry.

By applied psychiatry I mean the application of all practical knowledge, which is derived from the investigation of diseases of the mind and those physical and neurological conditions which properly come to the attention of the psychiatrist, not only to those unfortunates who are confined within the walls of hospitals, but to all social conditions which contribute to mental disease. That is to say, we must bring our hospitals to the people.

There is scarcely a State hospital for the insane in the country which is not able in some measure, if the effort were made, to bring the gospel of psychiatry to the community through the development of the social function of the hospital. A few hospitals in the country have already demonstrated through out-patient clinics and through organized social workers the value of bringing the hospital into intimate relation to the community. The reaction of this work upon the community is to bring about an attitude which is making the people receptive to the value of the hospital, and is giving them an insight into the benefits of scientific observation and care which they never before knew existed; and this attitude will gain for the hospital and for State care in all its activities, both material and scientific, intelligent and unlimited support. The methods and results of carrying out the social functions of the hospital should not be hidden in hospital reports, but should be published for popular reading in magazines and the press.

Another means, and the one of chief value as an educator, by which applied psychiatry may be realized is through the establishment of the psychopathic hospital in the heart of a large center. The establishment of reception hospitals and so-called psychopathic wards at existing State hospitals should by all means be encouraged, but we must not be deceived by the thought that the name "psychopathic" applied to a ward or wards of an established hospital, even if it be distant but a 10-cent car fare from the city, takes the place of the psychopathic hospital located in the heart of the metropolis.

I do not need to go into any detailed account of what such a hospital can accomplish in its house service, out-patient clinic and social service work. Thousands of persons are reached in this way annually. I am not dwelling now on the help which is thereby given, but I am bringing out the thought of the educative value of such an institution, the logical result of which will be that thereby public opinion will be so molded that it will prove to be one of our stanchest supports and most encouraging factors in the scientific pursuits of psychiatry.

I know of no State in the country in which the conditions are so favorable as here in Massachusetts for the carrying out of a constructive plan of organization for applied psychiatry. You have a clinical center in your psychopathic hospital which is not only a center for investigation, but which can become a great teaching center to furnish other parts of this country with men equipped to take positions as clinical directors and pathologists. With your number of up-to-date hospitals, some of them with laboratories which have already earned international reputation, you can carry out systematic investigation under central supervision. You have local boards of trustees favorable to all methods which bring enlightenment. You have your State Board of Insanity, alive to the humane and scientific sides of your subject. All these make Massachusetts a conspicuous example of a high standard of State care of the insane, — one which is reaching the people. We of some other States look to you to prove how the encouragement of scientific investigation leads to an applied psychiatry which touches the people upon so many sides that your methods will be followed elsewhere.

ROUTINE METHODS OF THE DANVERS STATE HOSPITAL LABORATORY: WITH COMMENTS ON THE COST OF MAINTAINING A LABORATORY.

By Lawson G. Lowrey, A.M., M.D.

In view of the papers here presented, many of which are based on material from this laboratory, it may be of interest to review the methods in use at this hospital which have been proved of value by experience. The methods have, to a considerable extent, been used by each pathologist in turn, but certain variations were, of course, introduced by each man. Only the stable parts of the methods which are still being followed are given. Details have been avoided.

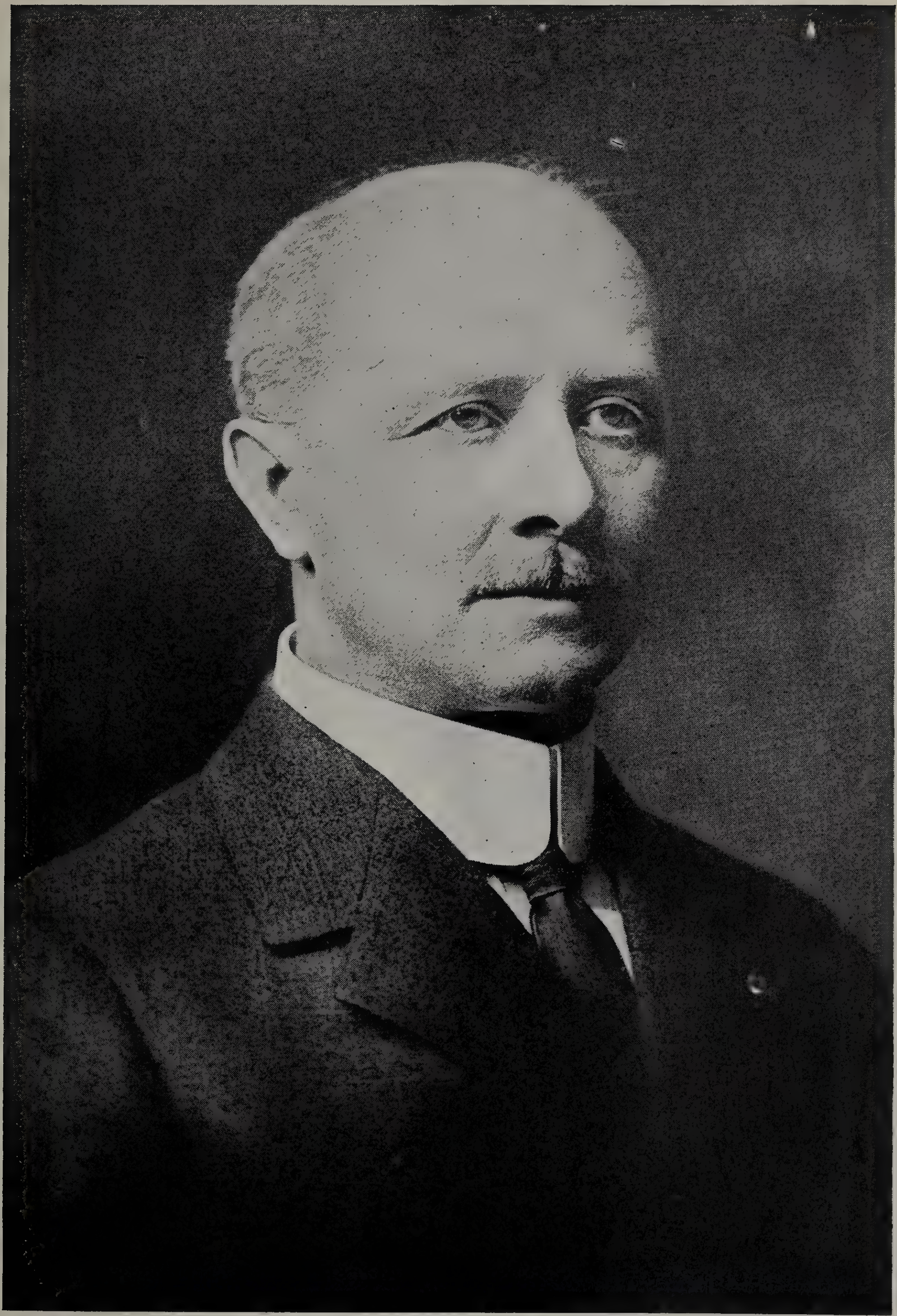
Autopsy Methods.

The performance of an autopsy is dependent upon the consent of the relatives or nearest friend, except in case the body is unclaimed at the end of three days following death, when no consent is necessary. Because of this law, many cases of great interest and importance are not autopsied. It has often been urged, and with justice, that there should be an autopsy on the body of any person who has been supported at State expense, if such is desired by the institution physicians. This would solve also the vexing problem of the interval between death and autopsy.

During the past year consent for autopsy has been obtained in about 58 per cent. of the deaths.

All bodies are removed from the ward to an ammonia process refrigerator as soon after death as may be possible. This refrigerator will maintain a temperature of 32° F., with very slight variations, although not automatically controlled. At this temperature the bodies will keep in excellent condition for a considerable period of time. Actual freezing, however, must be avoided if possible.

We have recently begun to weigh all bodies at the time of the autopsy. There seems to be no more reason for making an impressionistic statement regarding the weight of an individual, than for doing so in the case of the organs. To state that a body is "moderately well nourished" conveys a certain meaning to the observer, but the meaning may be entirely different to



H. W. Mitchell, M.D.

Assistant Superintendent, 1899–1907.
Superintendent, 1910–1912.

some one else. Furthermore, it is of the greatest importance to know the weight if we are to know that any organ is of the proper size for that special individual. A relatively inexpensive Fairbanks platform balance of 100 kilogram capacity is used. The body length is measured by means of a scale cut directly into the lead top of the autopsy table.

A brief but comprehensive description of the external findings and the body wall is dictated. We use in this hospital the Edison dictating machines, and the records are transcribed by a stenographer from the cylinders. This has advantages and disadvantages. If, as is the case here, the stenographer is also the technician, it is obviously an advantage, since she does not have to interrupt her work to take down the notes. On the other hand, it is much more difficult to correct any misstatement, and it takes some time longer to complete the autopsy. Also special care must be taken that none of the cylinders be broken, else the record is lost.

The organs are weighed and measured, as well as described. This is mentioned merely to call attention to the fact that all of the autopsies ever performed in this hospital, beginning in 1879, have had the weights of at least the larger organs set down. In the descriptions exact rather than impressionistic statements are made, and the description is made as if that were the first time one ever saw the condition, as, of course, is the rule everywhere. Our conclusions are, of course, always set down under the anatomical diagnoses.

The fixing fluids used at the autopsy are three in number. In Zenker's fluid are put pieces from each of the body organs, and from three levels of the cord. In 10 per cent. formalin we put pieces from all of the body organs and the remainder of the cord. When the brain is sectioned at the time of autopsy, pieces from certain different areas are fixed in 95 per cent. alcohol, Zenker's fluid and formalin. The remainder of the brain, or the entire brain when sections are not made at the time of the autopsy, is fixed in 10 per cent. formalin containing 0.6 per cent. of sodium chloride. When the brain is preserved entire, a thread is passed through the carotid arteries, and another through the pia mater of each hemisphere just behind the corpus callosum. These threads are long enough to bring up across the top of the brain jar after it is covered, and there tied. The brain is thus suspended in a practically isotonic fluid, base up, and is fixed without any pressure distortion.

If the brain is fixed *in toto,* it is allowed to harden for at least six months and preferably a year. It is then gone over again and the original description checked up and amplified, if necessary. If it presents lesions of certain types, it is then photographed. If there were time, it would be desirable to photograph all brains from certain classes of cases, for more intensive group study. At present there is only time for cases with certain rather definite lesions.

In photography we use a Cooper-Hewitt mercury vapor arc lamp, which frees us from having to consider outside light conditions. All of the photography is done with a vertical camera, using a 13¾-inch anastigmat lens and 5 by 7-inch plates. For a black background velvet is best. We find that Stanley plates give quite as good results and are much cheaper than other makes. For photographing sections, however, I prefer the Cramer Iso Medium, as these give greater contrast to the bleached out gray matter. For printing, Azo paper is entirely satisfactory and cheap.

After being photographed (or when cut up at autopsy) small blocks are taken from the first frontal, precentral, postcentral, first temporal, calcarine and hippocampal convolutions of each hemisphere, from the cerebellum, pons and medulla and in some cases basal ganglia. These blocks are strung on a white thread along with a slip identifying each, are embedded in paraffin, and sections stained in cresyl-violet.

The remainder of the brain is now jacketed with cheesecloth, labeled, and stored along with others in straight-sided stone crocks of 6-gallon capacity, which will easily hold 8 or 10 brains. Special care must be taken of the labels, since they are immersed in formalin solution. We use only the best quality of paper and India ink. To the wrappers, if desired, may be tied a long thread with a tag on the end. This tag is allowed to hang over the edge of the jar under the cover, and thus is never in danger of fading from the action of the solution. Furthermore, this offers a convenient way of finding any desired brain in the crock. Care must be taken to tie these securely to the wrapper.

From the pieces of organs fixed in Zenker's fluid, small blocks of appropriate shape are cut, embedded in paraffin, and sections prepared. We always prepare two slides, — one stained in hematoxylin and eosin, and the other left unstained so that any special stain desired may be used. Blocks from three levels of the cord and in certain cases from the cerebrum are pre-

George M. Kline, M.D.

Superintendent, 1912–1916.

pared by the Marchi and Weigert methods. Where desired, frozen sections of various organs are stained for fat. We are now testing the method of preparing all slides for routine work with the freezing microtome. This is a great time saver and is less expensive.

When all the slides for a given case have been prepared the microscopical diagnoses are made out. In doing this, a definite diagnosis is made wherever possible, otherwise a brief but comprehensive description of the slide is given. A valuable but little used lens — the 48 millimeter — is very useful in studying Weigert preparations.

The slides are stored in large boxes holding 100 slides, and two cases are put in a box. In four or five years, as the shelf space diminishes, the unstained slides are taken out and as many cases as possible put into a single box.

For purpose of illustration, we use either the microphotographic apparatus, or else a drawing by means of the camera lucida. Both possess advantages. Personally, I favor the use of the camera lucida and actual drawing, as I have yet to see the photographic reproduction of a microscopic picture which could equal a good drawing.

The blocks from the organs are preserved in lightning jars of appropriate capacity, either pint or half-pint. At present the original tissue blocks, the embedded blocks and the slides are available for over 1,000 autopsies.

When all of the observations concerning a given case, including any illustrations, are completed and the records have been typewritten, the protocol is filed until 50 (or 100) have been finished, when they are bound into a volume. The reports of the bacteriological investigations are bound in separate volumes. For each 500 cases a volume of the anatomical diagnoses is made up. As the clinical records are kept at some distance from the laboratory each protocol includes a short abstract of the clinical history of the individual.

Besides the protocol, there are a number of index records. These are very easily kept up by filling them in after each autopsy. They include the autopsy by number, by name, by diagnosis, by decade of life and the anatomical index of the lesions in the various organs.

CLINICO-PATHOLOGICAL.

One of the important functions of the laboratory is the testing of spinal fluids. A Wassermann test is performed on the blood serum of all patients entering the hospital (in the laboratory of the State Department of Health), and the spinal fluid is also tested in cases with a positive blood Wassermann and in cases with sufficient clinical evidence, despite the lack of a positive blood test. About 200 fluids were so tested in the past year.

The routine tests are: test for total protein with trichloracetic acid, for globulin by Noguchi's method and with ammonium sulphate, the gold sol reaction, and the qualitative cell count. I shall not go into details about these tests, as they are given elsewhere. I may state that, after trying all of the various tests recommended, I have chosen these as probably giving the maximum of information reliably.

For counting the cells, the Fuchs-Rosenthal chamber is very satisfactory. By using an 8-millimeter lens instead of a 16, the number can be very accurately determined, and a differential count is readily made.

Blood counts are made in about the same class of cases as in a general hospital. Thus in anæmic-appearing patients, or patients with 70 per cent. or less of hemogloblin by the Tallquist scale, a red count is made. In case of continuous fever, white counts are called for, etc. The technique is by no means peculiar.

Urines are tested from as nearly as possible every case admitted. The usual routine tests are used. Benedict's reagent is used for a sugar test, and all cases showing sugar have a quantitative test with Haine's reagent, and by fermentation. Any urine showing either albumen or sugar is tested daily until we are sure it is a chronic process.

The clinico-pathological records are kept on cards. Each specimen submitted is accompanied by a card from the physician on which the report is made to the physician in charge of the case.

BACTERIOLOGICAL.

No attempt is made at present to keep up the bacteriological routine previously a part of the autopsy routine. We are, however, prepared at all times to diagnose throat cultures, make autogenous vaccines, diagnose infections, and investigate the bacteriology of any special cases.

THE COST OF A LABORATORY.

The question naturally arises, from a consideration of the above routine, what does it cost to equip and maintain a laboratory? It is doubtless true that many institutions do not maintain a laboratory because of the bugaboo of "per capita cost." As a matter of fact, the laboratory is by no means as expensive as might seem, at first blush, to be the case. During the year 1915, the laboratory performed 99 complete autopsies and 1 partial autopsy; examined 190 spinal fluids, 793 urines, 8 throat cultures, 11 sputa; urethral and vaginal smears in 53 cases; prepared 6 autogenous vaccines; performed 2 Widal tests, 5 blood cultures, 30 blood examinations and 10 miscellaneous examinations. The running expense of the laboratory, for perishable supplies, chemicals, etc., was $400, of which $50 were expended for photography. In addition, $65 were spent for crocks, specimen bottles, etc., for storage. From this it is quite evident that the expense is by no means great.

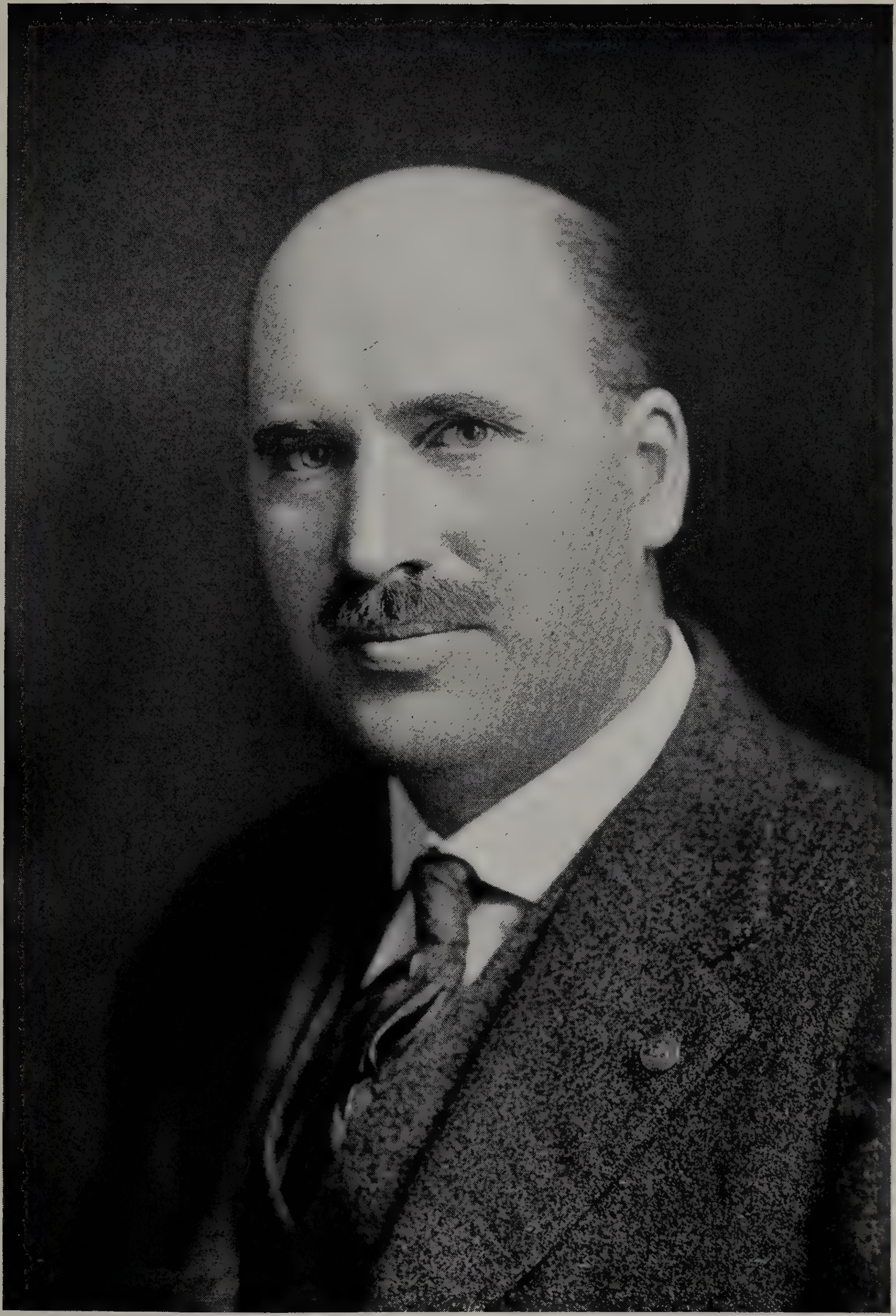
As for the first cost, the appended list of apparatus now on hand and in use in the laboratory (and in the wards for diagnostic purposes) speaks for itself. It is only necessary to point out that a plant may be equipped with much less than this at first, and the other items gradually added as the need for them develops and as funds are available.

At the same time, it should be emphasized that the laboratory budget should not be too niggardly. There must always be money for the expansion of work in various directions. Apparatus is needed from time to time. In fact, for a laboratory of this size, the budget should be about $1,000.

EQUIPMENT.

Autopsy tools: knives, saws, scissors, etc.
Autopsy table.
Platform scale for body weights, 100 kilogram.
Toledo self-registering scale for organ weights, 6 kilogram.
Glass blower.
Paraffin oven.
Rotary microtome, International Instrument Company.
Sliding microtome, Bausch & Lomb.
Minot automatic precision microtome, Bausch & Lomb, with special clamp.
Automatic freezing microtome, Leitz.
Zeiss microscope, ordinary equipment.
Zeiss II C microscope, compensating oculars and apochromatic objectives.

Achromatic condenser.
Spencer microscope, Model 44, ordinary equipment plus 48 millimeter and 8 millimeter lenses.
Abbe camera Lucida, Style C, Bausch & Lomb.
Cooper-Hewitt, special outfit No. 47.
Century camera, 6½ by 8½ inches, with plate holders and 5 by 7 inch and 4 by 5 inch kits.
Bausch & Lomb-Zeiss Protar lens, Series VII A, with aluminum volute shutter.
Telephoto lens.
Vertical camera stand.
3 Zeiss planar lenses.
3 Microsummar lenses.
Microphotographic apparatus, Bausch & Lomb.
Outfit for developing and printing negatives.
Sartorius balance, with platinum plated weights.
Troemer balance, for ordinary work.
Water still.
Vacuum filter pump.
Hot-air sterilizer.
Autoclave.
Arnold steamer.
Serum inspissator.
Bausch & Lomb incubator.
High speed, 16-head centrifuge, with regular and Babcock test trunnion cups.
Kjeldahl apparatus.
Kjeldahl digestion apparatus.
4-head centrifuge.
Hæmocytometers.
Plesch chromophotometer.
Complete stock of glassware.
X-ray outfit.
Blood-pressure apparatus.
Perimeter.

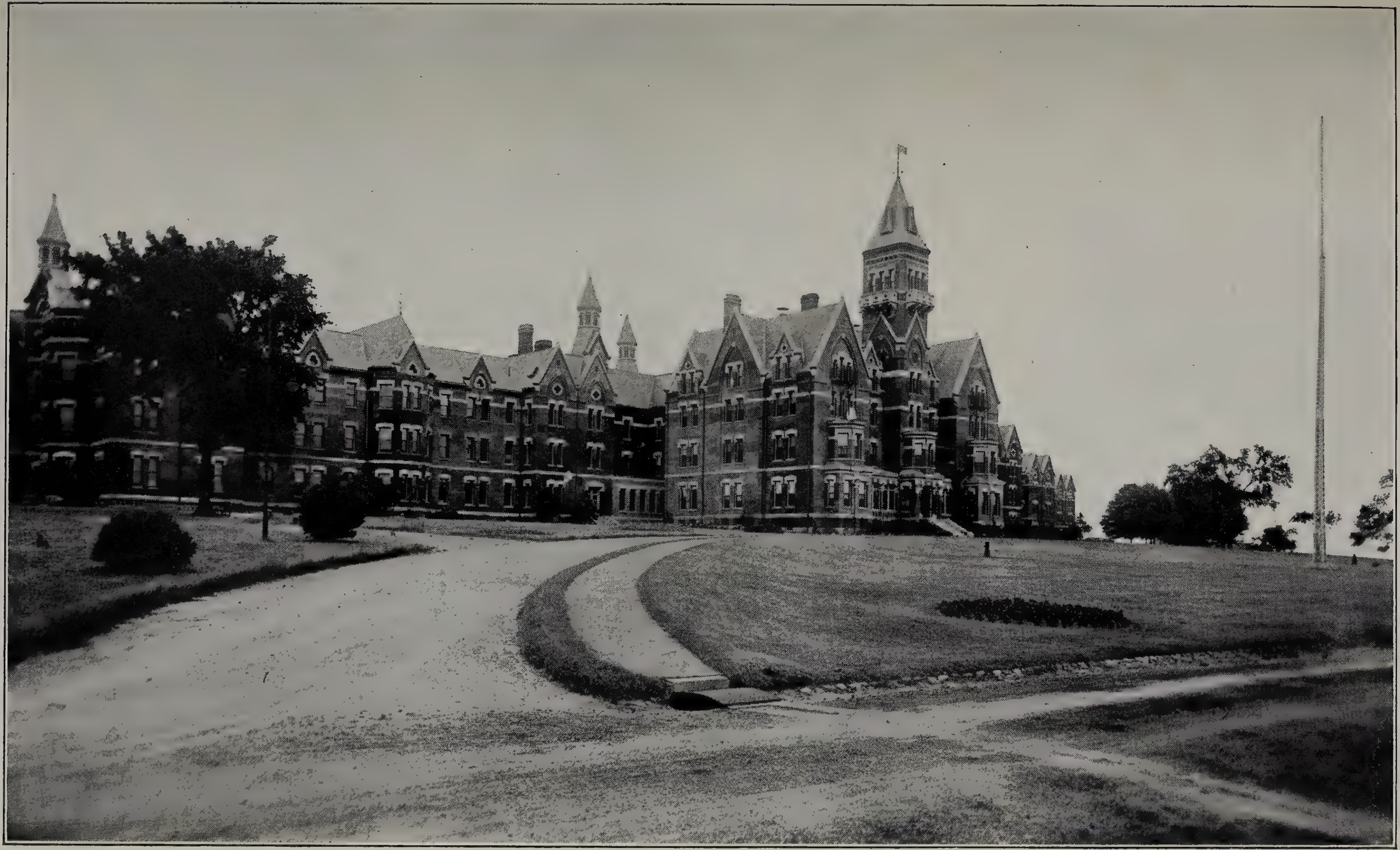


John B. Macdonald, M.D.

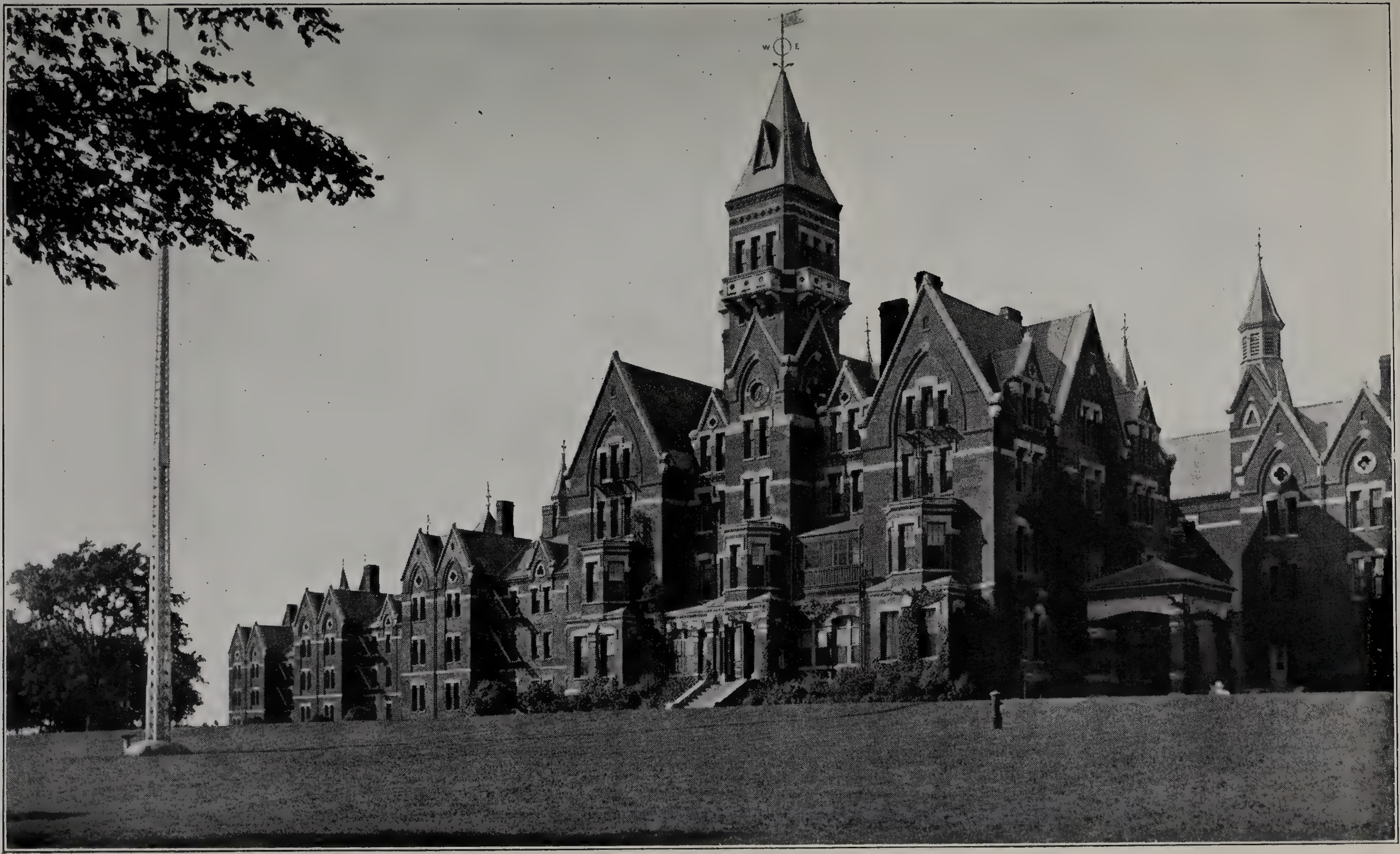
Assistant Superintendent, 1912–1916.
Present Superintendent. Appointed 1916.

PART II.

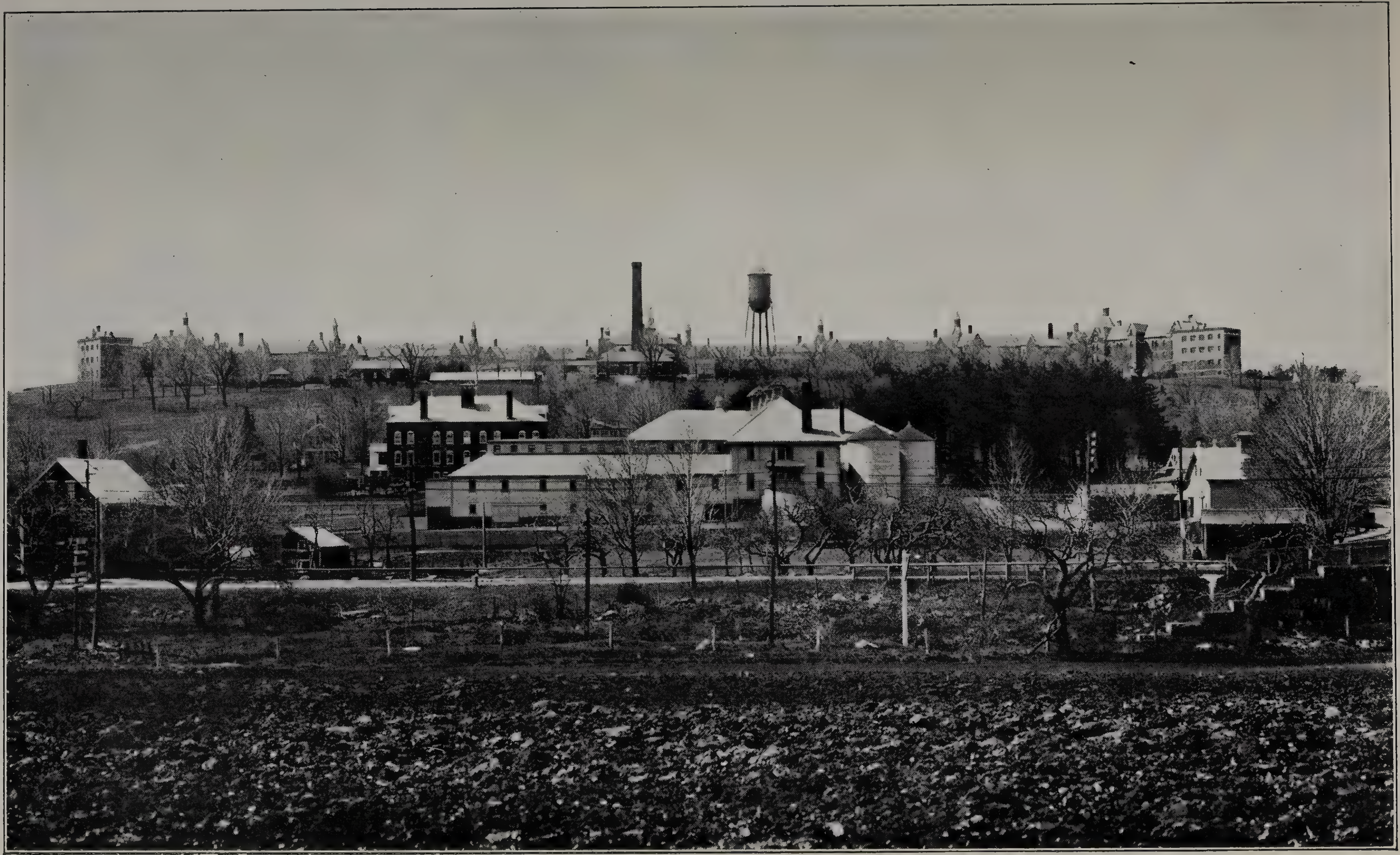
ORIGINAL INVESTIGATIONS.



Danvers State Hospital.



Danvers State Hospital.



Danvers State Hospital — showing Rear View of Main Group, Building for Fifty Patients, Power Plant, Water Tower, Barns and Employees' Cottages.

PART II.

A TOXIC PSYCHOSIS ASSOCIATED WITH TETANY.

By Albert M. Barrett,

PROFESSOR OF NERVOUS DISEASES AND PSYCHIATRY IN THE UNIVERSITY OF MICHIGAN AND DIRECTOR OF THE STATE PSYCHOPATHIC HOSPITAL, ANN ARBOR, MICH.

The group of symptomatic psychoses which occur with toxic disturbances from abnormalities of metabolism is not large, but is one of particular interest in that one finds among these possibilities of correlating the symptoms of disturbed mental function with tangible pathological influences.

Among the less common toxic psychoses are those which are occasionally met with in tetany. While tetany is a disturbance associated with a variety of etiological relations, and its pathogenesis is still unclear, there seems to be common agreement that the disease is one of disordered metabolism. The great majority of the cases of tetany show no mental disturbance. There are, however, in the literature a small number of descriptions of cases with mental symptoms which were severe enough to constitute well-defined psychoses.

Within recent time we have had an opportunity of observing a severe mental disturbance associated with a marked disorder of metabolism, and, for a part of the course, there were pronounced symptoms of tetany.

The patient, C. J., was a male, aged fifty-eight. His family history was unimportant. He had been a farmer, with average success, and aside from a tendency to worry needlessly, and at times to show undue irritability, his life was not notable until he was fifty-seven years old. At this time a son was convicted of a sexual crime and given a penitentiary sentence. The patient felt deeply about this and from then on his health failed.

He complained much of a pain in his stomach and was unusually despondent. His sleep and appetite were impaired and he lost 30 pounds in weight. These conditions brought about his admission to the State Psychopathic Hospital of the University of Michigan on Nov. 14, 1911.

The examination of his physical condition at his admission showed him to be rather feeble and moderately emaciated. There was no pathology of the heart. The lungs showed bronchovesicular breathing near both apices. The examination of the blood showed 4,510,000 reds and 9,260 whites, and 80 per cent. hæmoglobin. The blood pressure was 142, and the pulse rate was 76. The cerebrospinal fluid showed 11 cells per cubic millimeter. The albumen was increased about six times over normal; there was a faint Nonne-Apelt reaction for globulin. There was a negative Wassermann reaction on both fluid and blood.

The urine at the first examination was not abnormal. In many subsequent examinations, there were found varying numbers of granular casts and specific gravities varying from 1,008 to 1,022, usually not higher than 1,015. There was an absence at all times of albumen and sugar. After January 26 there were present excessive amounts of indican. A report from the laboratory of the Department of Internal Medicine on February 3, stated: "The indican in the urine is enormously increased, running as high as 100 milligrams for the twenty-four hours."

In the neurological examination there was found unsteadiness in his station and gait. The pupils and their reactions were not abnormal. The extraocular movements were done rather jerkily. The fundus in both eyes showed œdema of the retina. The special senses were not impaired. Nowhere was there any motor paralysis. Sensory appreciation was keen and accurate, except that he sometimes made errors in his localization of touch and joint movements.

Mentally, he was perfectly oriented. His comprehension of questions was a little slow, but otherwise correct. His mood was uniformly sad. He gave a clear, coherent account of the progress of his illness, and his spontaneous speech consisted largely of complaints about his various bodily discomforts. He complained much of gastric distress, and he raised large quantities of fluid from his stomach. An examination, by the department of internal medicine, showed "a typical achlorydria with absence of free hydrochloric acid; the presence of some combined acid; a total acidity of from five to ten, and hypermotility." He was put upon a finely divided diet and given hydrochloric acid. In the next two weeks he lost seven pounds. His mental condition varied from day to day. There were days when he would pay little attention to questions. His replies were given in monosyllables or grunts. Attempts at conversation or examination irritated him. On other days he showed more interest and would carry on a limited conversation. His replies were always slow in starting.

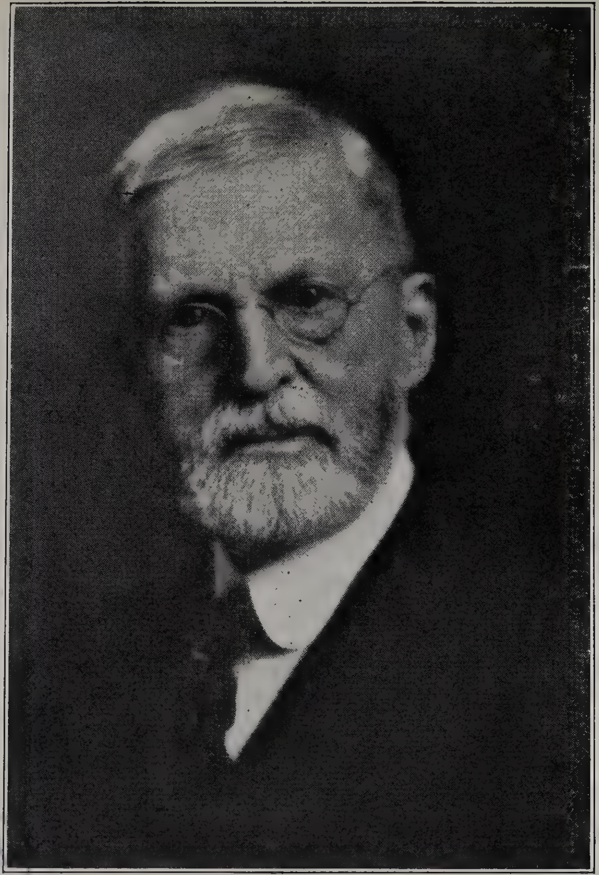
On December 13 he was for a short time confused and bewildered. He asked questions which could only have arisen from an unclear comprehension of his situation. His tongue was coarsely tremulous. The knee jerks were increased, the left more than the right. Movements of the extremities showed a moderate degree of spasticity. During the next two weeks the physical and neurological disturbances became more marked. He winked his eyes with greater frequency than usual, and with this there were associated fine twitchings of the lower lid. The muscles around the mouth showed a fine continuous tremor. His arms were held flexed at the elbows. The fingers were extended and held tightly approximated. The thumb was abducted. The hands were typically like that of the accoucheur position in tetany. Both arms and legs were spastic and he resisted attempts at moving them. All his movements of the extremities were ataxic and coarsely tremulous. His abdomen was tense and bloated. After an effective enema, the trunk and extremities became moist and clammy, and the stiffness of the extremities relaxed. Mentally, he was unclear in his comprehension. He talked more freely than usual, but his remarks were those of one in a delirium with terrifying ideas. He spoke of his head being "stove in from the wall falling on it;" that he was "lying on the floor of the old ranch;" and as he put his hands to his head, he remarked, "See, they are all blood." A few days later he became more stuporous. He lay on the bed making no effort to speak or help himself. When visited, he paid no attention to members of his family. His lower extremities were usually cold, and his skin was wet with abundant perspiration. There was a continuous flow of saliva from the mouth. Recently, he had a slight febrile temperature, on one occasion reaching 102.6. The pulse during this time varied between 64 and 100. Twitchings and jerkings of various muscles were usually present. These occurred in the muscles of the face, chest, arms, hands and the inner surface of the thighs. On one day he suddenly collapsed. The pulse was weak and for a brief period respiration ceased. He rallied from this without special treatment.

About December 30 the muscular twitchings became less marked. He was more alert in his mental grasp and talked more freely, but his answers showed confusion and were often irrelevant. This continued for several weeks. He was restless, and unclear in his comprehension and actions. Both visual and auditory hallucinations were prominent. He saw teams of oxen passing the window. He heard bells ringing and on one occasion he ran out in the hall trying to catch an imaginary train. Hallucinations were easily induced through suggestions. At all times he was disoriented. There was much spontaneous talk, made up largely of fantasies.

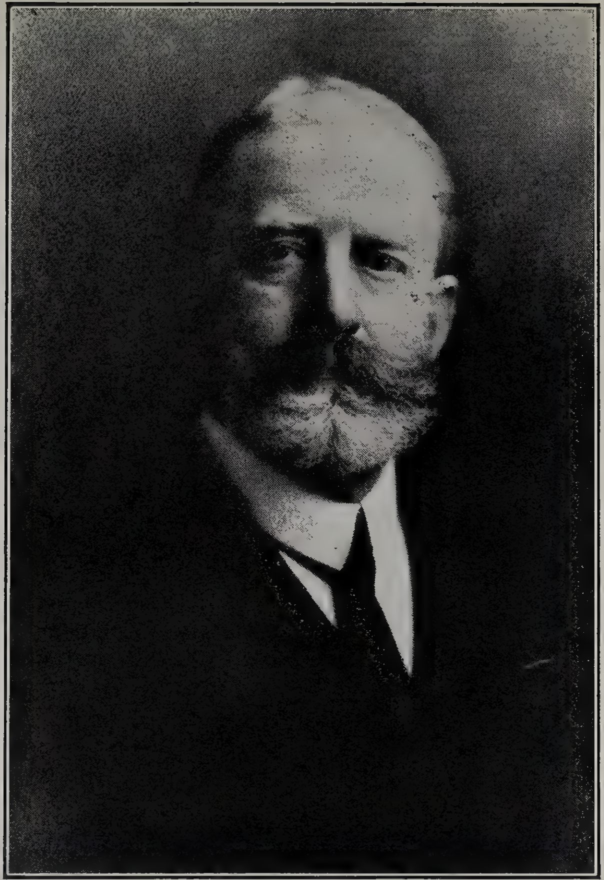
From time to time following admission, numerous examinations of the urine were made. The amount passed in twenty-four hours was much below normal. The specific gravity varied between 1,008 and 1,022. Albumen and sugar were never present. There were always to be found a few hyaline and granular casts. On January 26 it was found that the urine contained excessive quantities of indican. The amount of this was so large that the patient was referred for study to the Department of Internal Medicine.

The results of this study form the subject of a contribution by Dr. Agnew,[1] published in the proceedings of the Clinical Society of the University of Michigan in September, 1914. In a series of daily examinations extending over three months, the indican varied between a minimal excretion of .0107 grams and a maximal of .3718. During this period there were experimental variations in feeding and medication. At no time during his hospital residence was his diet rich in proteins. It seemed that the excretion was lessened during a period when the diet was largely composed of milk cultures of *Bacillus bulgaricus,* but otherwise the output could not be definitely influenced. The period in which the highest quantities of indican were obtained was following a period of active purgation and a restricted diet. On the whole, it seemed that some other explanation than intestinal disturbance was necessary to explain the marked variations which occurred in the excretion of indican. Dr. Agnew comments that he was unable to find in the literature comparable instances of such excessive amounts as were obtained in the present case. The average of 41 determinations was .074 grams, an amount seven times as great as the maximum usually regarded as within normal limits. It was not possible to correlate differences in excretion and variations in his mental state.

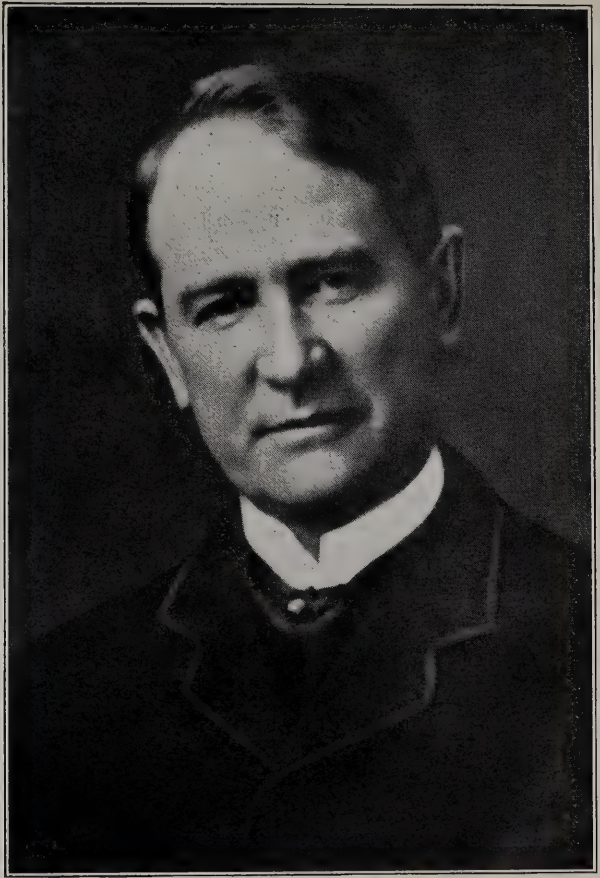
On January 27 he became stuporous. His talk was limited



James J. Putnam, M.D.
Pathologist, 1879–1880.



Henry R. Stedman, M.D.
Assistant Superintendent, 1879–1884.



Sanger Brown, M.D.
Assistant Physician, 1881–1882.

A GROUP OF MEN EARLY ASSOCIATED WITH DANVERS HOSPITAL LABORATORY.

to a few replies to questions that were put to him with unusual force. The muscular twitchings were again marked.

On February 7 he was active and clearer in his comprehension. He complained much of pain in the back of his head, and in his arms.

On February 10 the muscular irritability was marked and the hands were held in the attitude seen in tetany. Chovstek's sign and Trousseau's phenomenon were well shown.

On February 28 visual hallucinations were very vivid. He picked at the bed clothes and at times he was in terror at what he saw. Several times he spoke of an explosion of which he was in great fear.

On March 23 he continued unclear in his comprehension. Visual hallucinations were active. Often he would reach into the air for imaginary objects. His mood had lost its apprehensiveness and he was usually good-natured and at times he laughed at trivial occurrences. The pupils were unequal, but reacted normally to direct light. The right eyeball was more prominent than the left. The surface of the body was strikingly cool to the touch. Tested with a surface thermometer, the temperature over the lower legs registered 83.7°. Over the greater part of the body it varied between 90° and 93.5°. The right side was two degrees warmer than the left. The blood pressure in the brachial arteries varied, at different examinations, between 132 and 140.

During April his mental condition varied between periods of stupor and mild restlessness, when he was more clear in his comprehension. On a few occasions there was excessive perspiration and an unusually large secretion of saliva.

On May 5, in the morning, he cried much in paroxysms as if in pain. At such times the muscles of the arms and legs were tensely contracted. In the intervals between contractures, he was easier, but held himself drawn up in a guarded way. At other times there were coarse twitchings of various groups of muscles. These were prominent in the flexors and extensors, and interossei of both arms. Less frequently the arms showed slow tonic contractions. The hands were drawn into the accoucheur position. Trousseau's phenomenon and Chovstek's sign were easily demonstrated.

He developed decubitus over the sacrum and iliac crests. With increasing weakness and persistence of the muscular irritability, he continued to fail until his death on May 13.

The autopsy was performed a few hours after death by the department of general pathology.

The pathological diagnosis was: ascending thrombo-phlebitis of the right iliac and femoral veins; embolism and thrombosis of pulmonary vessels; purulent pneumonia; emphysema; atrophy and passive congestion of all organs.

The gross examination of the brain at the autopsy showed little that was pathological, excepting a rather marked congestion of the veins of the pia. The brain weighed 1,170 grams.

A more detailed examination of the brain, after fixation in 10 per cent. formalin, revealed nothing of importance. In removing the pituitary body, a relatively large cyst was seen, situated at the proximal part of the stalk. Subsequently, the entire pituitary body was cut into serial sections and the details and relations of this abnormality were made more apparent. The cyst measured 3 by 2.5 centimeters. It lay almost entirely within the glandular portion of the pituitary body, taking up about one-fifth of its area. It had a wall of epithelial cells and its contents were a finely granular substance, with a few larger masses. The greater part of this substance was stained deeply with basic stains. Scattered among these were what appeared like disintegrating cells and nuclei, which had acidophilic staining qualities. This cyst pressed upon the nervous portion of the pituitary and considerably distorted its normal form.

The thyroid gland showed the greater number of its follicles changed into small cysts filled with colloid substance. The parathyroids had been carefully dissected out, but only one was found as an independent structure. This appeared in sections as a structure measuring 5 by 3 millimeters. It was free from hemorrhages or any demonstrable pathological change. The only trace of another parathyroid was a mass of parathyroid tissue lying imbedded within the thyroid gland. This appeared as a compact island of richly cellular structure, surrounded by a connective tissue capsule. This island measured 3 millimeters in cross section. The stroma was moderately increased. Otherwise, this part of the parathyroid was not pathological.

The cortex of the brain showed, by the method of Nissl, very severe degenerative changes among the nerve cells. These were widely distributed and occurred through all of the layers. The greater number of the large and medium sized pyramids had shrunken bodies, and the cell, as a whole, was deeply stained. The nucleus was shrunken and stained diffusely. A far more common type of change were cells with swollen bodies, from which most of the chromophilic granules had disappeared. The ground substance of the cell was stained diffusely and the processes were visible for longer distances than is usual. The nucleus was not sharply differentiated from the other contents of the cell's body. In many cells the nucleus was pushed toward one corner of the base. Most cells contained excessive amounts of yellow pigment.

The neuroglia showed no progressive changes. There were many cells with well-developed bodies, but these were usually shrunken in outline. The lymph spaces of the blood vessels contained excessive amounts of disintegration products.

In the para-central lobules the Betz cells showed the type of change met with in retrograde degeneration of the cell following disease of the fibre process of the cell. In this type of change, the cell body was swollen. The Nissl granules had broken up and were in process of disappearance. This change began at one side of the base of the cell and spread until the cell body was filled with a finely granular substance. During this process, the nucleus was pushed progressively towards the cell wall. Changes of this type were found among the cells of the thalami and medulla.

In preparations to show fat, it was found that quite generally the cell bodies showed relatively large amounts of lipoid pigments. Often these extended into the cell processes. The lymph spaces of the vessels were crowded with fatty products.

The changes observed in this case were such as have sometimes been found in the cortex of the central nervous system in severe toxic disturbances. We have observed quite similar changes in the cortex, in pellagra and in delirious conditions of obscure, but presumably toxic, etiology. As to the relations of these changes in the cortex to tetany, we are not able to give anything that is definite.

There are in the literature but very few references to the pathology of the central nervous system in tetany. In a case described by Ferranini[2] there was hyperemia of the pia, brain and cord substance. In the central nervous system, the ganglion showed central chromatolysis and the neuclus was placed at one side of the cell. Weiss[3] found in three cases of "tetania strumipriva" swelling of the ganglion cells of the anterior horns of the spinal cord.

In some experimental work by Prof. Wm. F. Koch on the effect of the removal of parathyroids upon metabolism, we have seen similar changes in the cortex of dogs, which, following removal, have died with symptoms of tetany.

In other instances of tetany, there are a number of reports of entirely negative findings in the central nervous system.

Psychoses, associated with tetany, are not limited to the tetany which occurs in gastrointestinal disorders. They have been described in tetany from thyroid and parathyroid disease (Weiss,[3] Kraepelin,[7] Schultz [8]) and in tetany in which no mention was made of etiological relations (Frankl-Hochwart,[4] Bonhoeffer [9]).

In all instances, aside from the present case, the symptoms of tetany appeared either before the mental disturbance or at the same time.

While in this case at the beginning of the disease, the symptoms of mental depression seemed to bear a relation to the emotional influences of his family situation, there were also evidences of a physical deterioration. This he described as a "general breakdown." "He tired quickly and his strength seemed to leave him." Some time after this, gastric disturbance developed, and after he came under our observation, seven months after the onset of the mental symptoms, there were many evidences of severe physical disease. The gastric disturbances were severe. He was emaciated and there was marked muscular weakness. From then on, the mental symptoms became more severe, and took on more specifically the type of disturbance met with in toxic disorders. At no time was he clear in his comprehension, and the symptoms showed a marked variability between periods of stupor and periods of apprehensive excitement, with hallucinations and short intervals when he became more lucid and less restless.

The evidences of disturbed metabolism became more marked. At times there were periods when he had diarrhœa, and at other times constipation which required medical treatment. The urine showed excessive elimination of indican and signs of a low-grade nephritis. There were vasomotor disturbances of increased secretion of saliva, increased perspiration, and differences in surface temperature. Soon after admission, there were symptoms of increased neuro-muscular irritability, and at times isolated periods when definite symptoms of tetany were present. Toward the latter part of the course, these were more constant and more marked.

The psychoses which have been described as associated with tetany have certain features in common which form a rather characteristic, although not specific, group of symptoms. These features are: an unclear comprehension; a terrifying character to the hallucinations; and excitement with marked apprehensiveness. There occurs usually a periodic variability of the symptoms; at times there may be stupor lasting sometimes for days; then days with marked apprehensiveness, confusion and excitement, and others in which there will be periods of quietude, with seeming improvement, but through all these persists the unclearness of comprehension. These features stand out strongly in the present case.

Lapinsky[5] has directed attention to this variability in a case of tetany with gastrointestinal disturbance. When diarrhœa was present, the consciousness was comparatively clear; when this ceased, the mental condition changed. When constipation was present, the patient sometimes showed tetany and signs of being in pain, and at other times there was extreme unclearness, with excitement. In our own case, there were several short periods of diarrhœa and during each of these it was noted that the man was brighter and stronger. In several periods of constipation, there was either stupor or excitement.

This variability is occasionally observed in toxic psychoses of different etiological relations and may bear some relation to periodic variations in the capacity for elimination of a harmful substance.

The excessive production of indican in this case is of some interest in that it has been noted in another case of tetany (Hochhaus[6]). While an excessive output of indican is supposed to bear some relation to intestinal disturbances, in this case there are suggestions that its production must have some other explanation. In spite of active purgation, and experimental feeding to reduce the putrefaction of proteids in the intestine, the quantity of indican eliminated in the urine could not be notably reduced. As to the part borne by the parathyroids in the production of the disorder, there is nothing certain in this case. The glands were not normal, but hardly enough altered to produce such a serious disturbance as was present. The fact that one gland was entirely included in a much diseased thyroid may have some significance.

The occurrence of the large cyst of the cerebellum is interesting, but whether or not it had anything to do with the general disturbance is unclear. While small cysts of this particular region of the pituitary body are not uncommon, we know of no instance in which one of as large size was observed. There was an entire absence of the usual symptoms of pituitary disease. It may be that a cyst of this size brought about a disturbance on the balance, which is maintained by various glands of internal secretion upon body metabolism.

The fact that mental symptoms developed several months before the appearance of the tetany, and that this did not appear until evidences of a disturbed metabolism were quite well marked, would indicate that the tetany was not in itself a primary disturbance, and that the psychosis present was dependent upon a toxæmia of which the tetany was a coincidental feature.

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   Weiss: Wiener med. Presse, 1883, S. 737.
4. Frankl-Hochwart: Nothnagel's Spec. Path. u. Path. Anatomie, Bd. XI., Th. II.
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ADVANTAGES OF A PATHOLOGICAL CLASSIFICATION OF NERVE CELLS, WITH REMARKS ON TISSUE DECOMPLICATION AS SHOWN IN THE CEREBRAL AND CEREBELLAR CORTEX.

By E. E. Southard, M.D., Boston.

Last year I brought before the association a communication on the direction of research as to the analysis of cortical stigmata and focal lesions in certain psychoses.[1] Therein I essayed to present some reasons why the present neuropathological situation is not entirely hopeless, even when we approach the fundamental genetic problems of mental disease. I felt that there was much warrant for declaring that the stock of structural investigation, so far from having dropped below par, was indeed a very promising stock. My chief point was that, in the analysis of the cerebral cortex in mental disease, advantage must be taken of the transition planes between "sensory" and "psychic" tissues as provisionally defined by the modern cortex topographers,[2,3] for the purpose of observing the differential reactions of the so-called "sensory" and "psychic" tissues to identical conditions of a disturbing or noxious nature. For these adjacent zones of "sensory" and "psychic" tissue, whatever their embryogenesis or special physical and chemical natures, are as a rule under identical mechanical conditions (*e. g.*, of vascular supply, of elasticity and pressure, of heat and the like), and may be safely conducted through the enormous gamut of physical and chemical change involved in modern microscopic technic under conditions so nearly uniform that without difficulty the "visuosensory" and "visuopsychic" tissue types, the "auditosensory" and "auditopsychic" tissue types, as well as many other contrasting types, can be observed under the selfsame coverglass. Of course the technical difficulties are greater in the way of comparing two co-ordinate portions of a given cortex type in the two hemispheres, since the technic of "total" brain sections, while suitable enough for fiber studies of an anatomical nature, is unhappily as yet not suited to the finest studies. However, much can be learned from a systematic comparison of tissue types in the two hemispheres as well as from a study of immediately adjacent cortex types. Perhaps I do not need to insist that the final truth or preciseness of the designations of cortex tissue as "sensory" and "psychic" is not involved in any question as to the value of studying these tissues, since it is safe to say that every one is now agreed that at least some part of the mind is related with some part of the cortex and that all parts of the cortex are more or less directly related with one another.

Last year I presented a few examples to illustrate my general contention that so-called "sensory" and so-called "psychic" tissues may show a differential pathological reaction despite their adjacency and apparent subjection to identical physical and chemical conditions. My examples were, it may be recalled, from the comparatively well charted visual area (calcarine — "visuosensory," common occipital — "visuopsychic") and the somewhat less well understood common sensory area (postcentral gyrus, susceptible to a similar subdivision).

The conclusion is inevitable, whether or not my special contentions are in detail correct (notably my correlations between "visuopsychic" tissue gliosis and visual hallucinations and between gliosis of an area related to complex kinesthesia and the symptom known as catatonia, [4, 5]) that the general contention must remain standing, to the effect that neuropathology has here a method which, however tedious and expensive, is surely rewarding to the extent of showing something pathologically different in two closely adjacent areas under identical general vascular conditions.

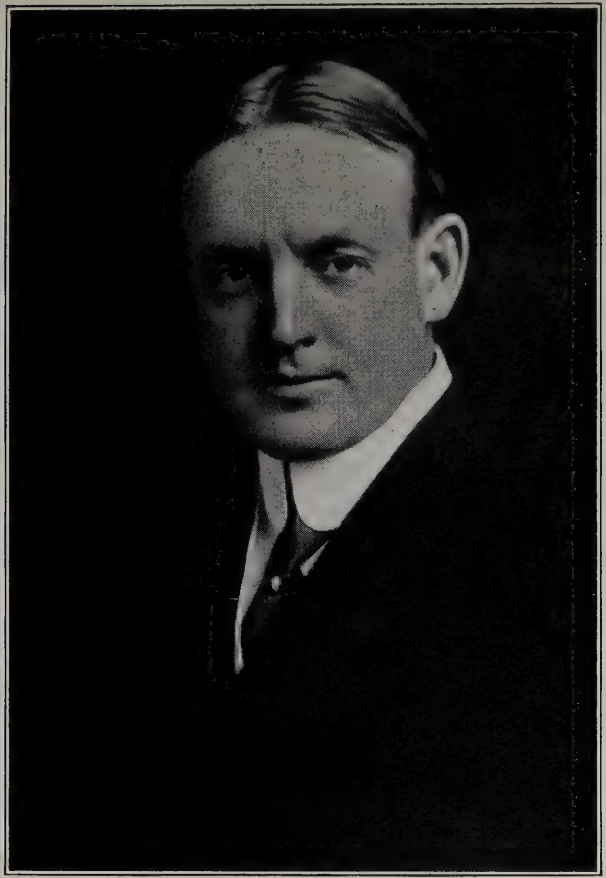
This year I wish to animadvert in a still more general way upon the topic of *microlocalization* in the cortex. Whereas my argument may seem immediately foreign to the internistic aims of the members of this association, yet I am convinced, (1) that the claims made are claims of a distinctively pathological (and not generally biological) method of study, and (2) that internists are those who do see, or should see, the value and applicability of such essentially pathological (medical) methods to such topics as modern psychiatry.

I know that I should by rights dwell a little on that portion of my title which speaks of the advantages of a "pathological classification" of nerve cells. We pathologists (taking all physicians for the moment to be pathologists, as in a sense they are well-known to be) are nowadays too prone to regard our methods and classifications as biological and as without further specificity. One might as well, in the opinion of the writer, dispose of physiological methods in terms of physics and chemistry, or the method of physics as a compound of geometrical and phoronomic methods. However that may be, it seems clear that the pathologist has much interest, not only in those metric and statistical methods which modern biology employs, but also in what may be termed "survival values." The term "survival values" has a Darwinian ring and perhaps justifiably so. Yet when we are considering the survival value not of an organism but of parts of organisms, the simple Darwinian aspect of the conception alters. For we have in mind, not so much synthetic effects, as analytic effects. Gowers' conception of differential "abiotrophy" has something in common with the doctrine of distinct differential survival values. To be sure, the Gowers concept has rather more to do with certain tissues that are as it were run out or run down than with tissues interfered with differentially by disease. The concept of abiotrophy is rather more a concept of primary or idiopathic ceasing of a tissue to thrive than a concept of a thriving actively stopped or blocked. In brief, the concept of survival values here discussed is rather more a matter of the internal economy of the multicellular metazoan than a matter of Darwinian survival of whole organisms. And, again, the concept of survival is of survival, not merely in stable conditions (like the running of a clock until it stops) but in unstable conditions (like that of a clock stopped by some external force).

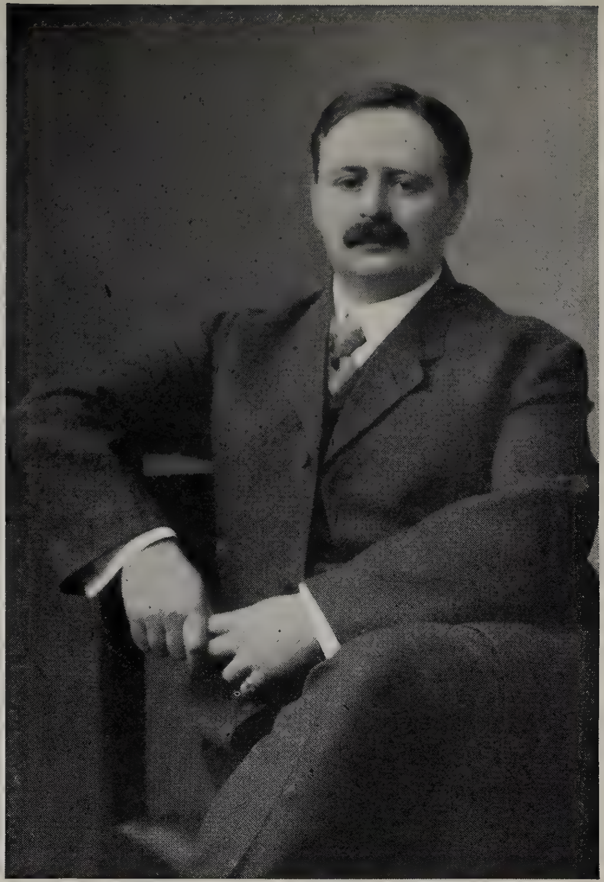
This is not the occasion to discuss the logic of methods in pathology or in neuropathology. It is sufficient to contend that tissues and cells appear to have differential vitalities and that these differential vitalities appear under the guise of a difference, not merely in what Bergson might call the *elan vital,* but also in the powers of resistance of the tissues or cells. Now the latter have not been sufficiently studied in the concrete, especially in neuropathology, despite the fact that neuropathology is supremely well characterized for such study on account of the variety of cells packed away in small geometrical units in the central nervous system. We should be able to study effectively the indices of resistance of nerve cells. A truly "pathological" classification of nerve cells might then be a classification of nerve cells according to their indices of resistance and survival under a variety of conditions. Naturally we are a number of years away from even the more obvious of such classifications. I wish to make it my present task to present a striking contrast in apparent survival value of various apparently homologous elements of the cerebral and the cerebellar cortex.

My conclusions naturally touch, in the present phase of neuropathology, only a few of the cellular elements of the cerebral gyrus and the cerebellar lamina respectively. Moreover, my conclusions as to the curious distinction in power of resistance between the large Betz cells of the precentral gyrus of the cerebrum and the large Purkinje cells of the cerebellar lamina are not founded on a thorough-going systematic study of the reactions of these cells under all known physical and biological conditions. A systematic study of a still more general nature is of course highly desirable, although it cannot be carried out in any existing laboratory with the funds at the disposal of neuropathology, a science in general almost inconceivably neglected. Perhaps I would best term my results "impressions" rather than "conclusions," based as they are upon observations confined to such effects of local hemorrhage, intoxication, exudation, and the like, as the natural experiments of human neuropathology permit.

Under ideal conditions, we should doubtless approach the matter of neurones from the geometrical side and describe and measure, name, and classify all available nerve cells in the major types of animals, including man. Such a task has been reasonably well carried out for the more easily available cells of the circulating blood. The necessity of executing a similar plan for fixed tissues has not appealed to the histologists to any convincing extent, and perhaps rather less so in neurology on account of the world's habit of postponing neurological work until other apparently simpler affairs are well in hand. Only of late has a classification of neurones from the standpoint of mechanics been attempted, and even such work as that of Dolley and Crile has suffered from the lack of fundamental metric work done by histologists. It is naturally difficult to evaluate the various metamorphoses of the Purkinje cells which Dolley and Crile are inclined to regard as of dynamic significance when so little is known as to the mechanical and physicochemical conditions under which nerve cells of all sorts must labor. Accordingly, it seems unsafe to draw extensive conclusions of a physiological or neuropathological nature from what we at present know of neurocytology, whatever opinion we may hold as to the objectivity of the Purkinje cell findings of recent American workers. There can be no doubt, however, that the Purkinje cell



Albert M. Barrett, M.D.
Pathologist, 1902–1905.



Elmer E. Southard, M.D.
Pathologist, 1906–1909.

is a peculiarly feeble cell under a number of conditions which can be in part defined. There can be no doubt that Dolley, Crile, and their followers have selected a cell of considerable lability, that is, a cell with a comparatively low index of resistance to at least certain disturbing or noxious influences.

I had occasion a number of years ago to observe the extraordinary lability of the Purkinje cells in some work on the neuroglia framework of the cerebellum in cases of marginal sclerosis[6] (1905), and again in some work on lesions of the granule layer of the human cerebellum communicated at the meeting of the American Association of Pathologists and Bacteriologists in 1906.[7] At that time I noted that Obersteiner,[8] so long ago as 1871, and Kirchhoff[9] in 1882, had described absence of Purkinje cells from atrophic areas in the cerebellum. In fact, in my second paper on the cerebellum above mentioned, I noted as a "familiar fact" that the great elements of the Purkinje cell belt are the first to undergo destruction. Interest in those days was directed rather at neuroglia reactions than to essential changes in the Purkinje cells themselves. In that older discussion, I pointed out that in many types of lesions the Purkinje cell belt is the initial seat of activity, which activity takes the form of neuroglia cell overgrowth. The Purkinje cell layer must be in fact regarded as a *locus minoris resistentiæ.* In the present year I was pleased to observe in the course of some work[10] done in the Psychopathic Hospital laboratory by Dr. Egbert W. Fell, the striking tendency to the deposit of fat (demonstrable by the Scharlach R method) in and about the Purkinje cells in cases of mental disease apparently due to intoxication or infection (the group of so-called "toxic" psychoses), although Dr. Fell was not able to discover similar intracellular changes in a variety of other more chronic conditions. There is good reason then why modern workers should choose the Purkinje cells of the cerebellum as a favorite field for the study of the effects of a variety of changed conditions.

The point of my present communication is that the large Betz cells of the precentral gyrus, taken as representing the motor cortex, are far less labile than the Purkinje cells. The likelihood that Betz cells would withstand relatively tremendous physicochemical changes was more or less consciously described in my paper of 1908 on the "Mechanism of Gliosis in Acquired Epilepsy."[11]

In casting up a program for the better development of neuropathological research, I could conceive no better program than the investigation of neurones from the standpoint of their differential lability. Expressed otherwise: What is the index of resistance? What is the vital capacity? What the viability or "survival value" of the different cells? In default of a complete geometric classification, in the absence of any signs of a phoronomic classification (indeed, such phoronomic classification is unlikely to have great scope in the cells of fixed tissues), in the prevalent feeling of grave doubt as to the virtues of a mechanical classification (whether this be taken from the standpoint of equilibrium or from a kinetic standpoint), we must turn perhaps to a more concrete method of classification. There are some signs of feasibility perhaps in the tinctorial classification proposed by Nissl, although this eminent worker is far from considering his tinctorial classification as based on anything but what he terms "cell equivalents." Aside from this endeavor of Nissl, which logically derives from Ehrlich's proposal of methylene blue as an agent by which specific characters of cells might be observed, there are few or no traces of physical and chemical classifications in any stricter sense. Thus, should one inquire whether the elasticities of nerve cells have been studied or whether we know much concerning the effects of pressure upon nerve cells or the phenomena of their so-called "capillary" chemistry, we should find an almost Egyptian darkness to prevail. Something, to be sure, is known concerning the thermal metamorphism of cells, at least the disruptive and destructive effects of heat. The various other branches of physics have been very largely neglected by the neurocytologists.

To illustrate the difficulty of the situation, I have been accustomed to quote from Sherrington a laborious catalogue of changes which might occur at the synapses, which Sherrington himself defined.[12] In the light of this catalogue, which I give below, the condition of neurocytology might be regarded as a desperate one; still, if the physical possibilities of the synapses can be defined even to this degree, the outlook is really not desperate. The synapses, according to Sherrington, "might restrain diffusion, bank up osmotic pressure, restrict the movements of ions, accumulate electric changes, support a double electric layer, alter in shape and surface-tension with changes in difference of potential, alter in difference of potential with changes in surface-tension or in shape, or intervene as a membrane between dilute solutions of electrolytes of different concentration or colloidal suspensions with different sign of charge." Accordingly, what chance might a "pathological" classification of neurones possess? At first sight, a negative answer would be given by almost any biologist. Before attacking such a topic from the pathological point of view, should there not be a congress of specialists, if not in geometry and phronomics, then at any rate in mechanics, physics and chemistry, which congress should lay out a program of metric and quantitative work upon which conclusions of a pathological nature might properly at some future date be grafted? In point of fact, the situation of the pathologists is not so hopeless. The pathologists' work need not be postponed. As I have elsewhere[13] and in a quite other connection been emboldened to state, pathology has its short cuts. It is perhaps a science of short cuts to biological conclusions. For example, it would be difficult to estimate how many decades it would have taken a congress of workers in physiology and in normal cytology, to discover the Virchowian principle, *omnis cellula e cellula.* From a study of exudation, Virchow was led to his interesting generalization after a comparatively brief period of work. Another instance may suffice from an entirely remote field. A tremendous impetus to the study of human character has beyond question been given by William James's *Varieties of Religious Experience,* a book which may be said deliberately to adopt the study of caricatures of character as the best means of coming at a reasonable notion of normal character types; at least, such I believe to be the trend of psychobiological study since the publication of that work. To be sure, the task of describing and evaluating character is, if possible, still farther from completion than the task of cellular biology in general and of neurobiology in particular.

The logic of pathology has nowhere been comprehensively studied so far as I am aware; even so gigantic a work as that of Wundt on *Logik,* written by a man of great physiological as well as psychological insight, fails to consider systematically this topic. It may well be, however, that the specific logic of pathology, as far as it is not identical with that of physiology, physics, and chemistry, is somewhat dependent upon the theory of survival values of cell units. The death point of a cell under varying conditions is a far more definite datum for study and interpretation than the majority of quantitative variations which the students of the normal histology, physiology, and the like are able to contribute.

However true or relevant all this may be, there surely does attach a certain intrinsic interest to studies in the death point of nerve cells. Take, for example, such a question as the nature of those almost entirely obscure mental diseases known as dementia præcox and manic-depressive psychosis, in the latter of which diseases singularly little can be observed in the gross brain.[14] Let us suppose the indications of a special line of attack upon the histology of manic-depressive psychosis (as presented in my communication[15] with Bond in 1914) to be sound. Still the pigmentation or lipoid deposits of the cells would remain merely quantitatively different from those found possibly under normal conditions or in conditions of senescence. Far more convincing here would be such results as those of Orton in his study of satellite cells in fifty selected cases of mental disease.[16] For the occurrence of satellite cells (so-called satellitosis) in the nervous system in increased number doubtless argues far more than the stationary changes that are normal to nerve cells, far more than mere alterations in the "self-supply" of their metabolism. In fact, perhaps satellitosis or neuronophagia may be regarded as definitely denoting a certain disappearance of elements or portions of elements normal to nervous tissue. At least such might be our best hypothesis in the light of the contentions of Weigert notably in his studies of the neuroglia[17] in 1895.

The contentions of my communication before the association last year (as to satellitosis, or overgrowth of a certain kind of neuroglia cells in the so-called "visuopsychic" area when no such overgrowth was demonstrable in the immediately adjacent "visuosensory" area) are obviously based upon identical conceptions. To throw into sharp focus the importance of such a comparative study of death points of cell types in the cerebrum and cerebellum respectively, I will reproduce two diagrams of the neurone supply of the cortex cerebri and of the cortex cerebelli respectively, as used for some years in my undergraduate course in neuropathology. A diagram of a similar nature, involving other neurones, has been before published in a paper on the optic thalamus.[18] The principle of these diagrams was communicated by Dr. S. T. Orton and myself at the meeting of the American Association of Pathologists and Bacteriologists in 1913, but has remained unpublished.

Fig. 1 deals with the neurone supply to the cortex cerebri, and is largely based upon prevalent ideas as to the course of impulses in the cerebral cortex, taking the precentral gyrus as the best known tissue. The diagram enables one to dispense with the schematic semi-diagrammatic pictures found in most text-books and based upon more or less thorough idealization of actual pathological conditions. The ideas expressed by the diagram follow rather more closely the ideas of von Monakow in his *Gehirnpathologie* of 1909 than those of other authors. The arrows indicate the possibility of numerous short cuts which may well correspond with short cuts actually used in function. The oblong unit containing the term "corticospinal" is of course the neurone whose cell body has long been known as the giant pyramid or Betz cell. If, now, an impulse passes through the "thalamocortical" unit so called (the question of whether impulses run directly or by two or more units from the lower centers to the precentral gyrus is not essential to the point at issue), then it may well be that

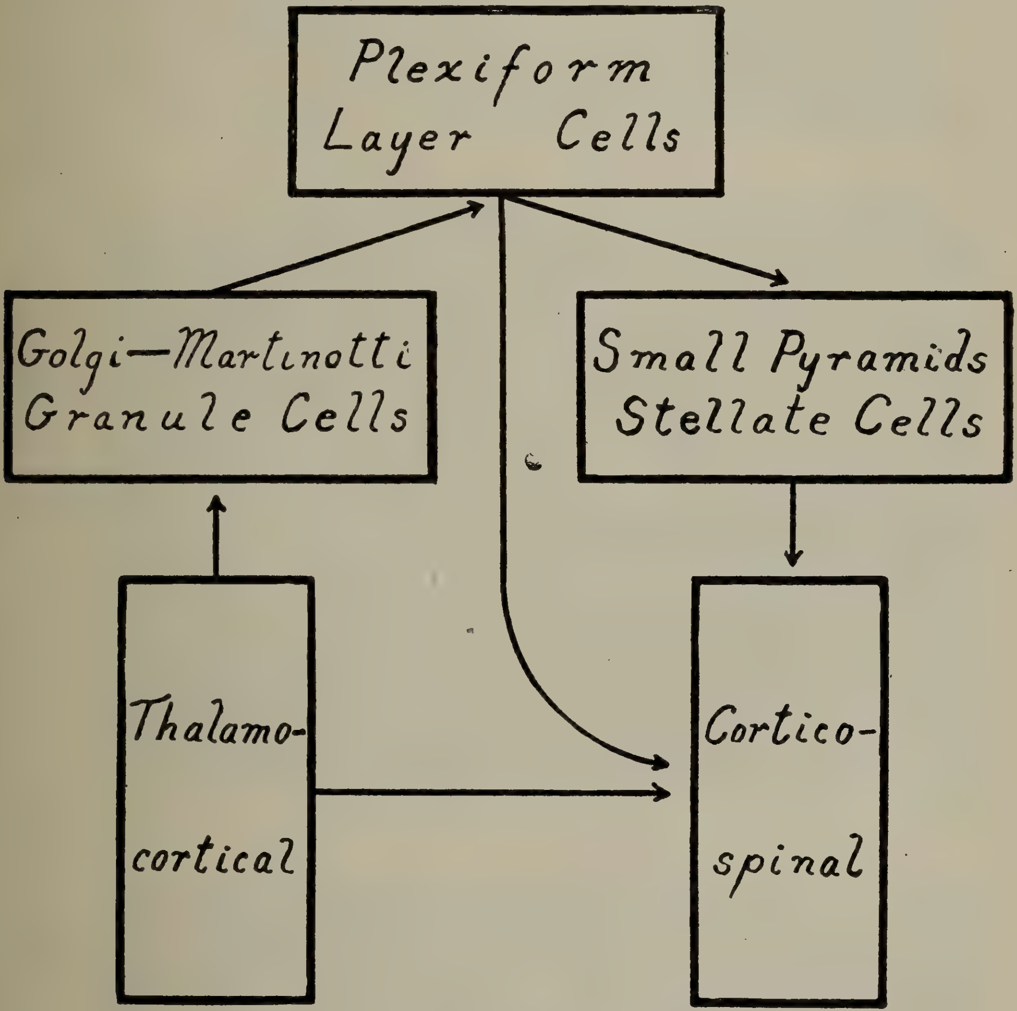
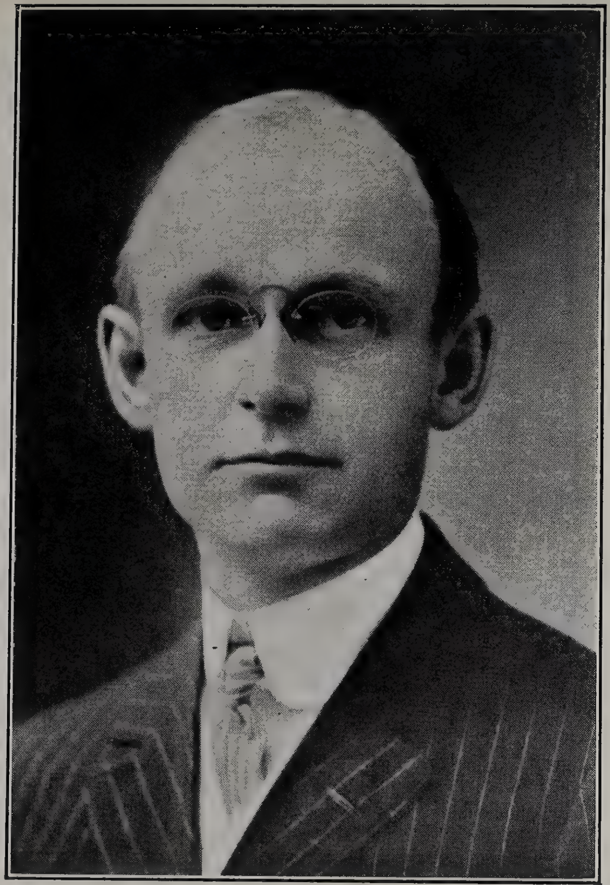


Fig. 1. — Neurone supply of cortex cerebri.

sundry dendritic connections permit impulses to be passed directly into the Betz cell, as indicated by the arrow running from left to right from the unit named "thalamocortical" to the unit named "corticospinal." Possibly such a course of impulse is normal for certain relatively fixed and habitual neural processes. However, other paths are possible, and the higher the evolution of the animal, the more elements exist through which complicated paths may cut themselves. The majority of authors now consider that the granule cell layer or stellate cell layer divides the tissues of older evolution below from the tissues of more recent evolution above. It is regarded as an approximation of truth to say that the entire supragranular (suprastellate) system of paths may be regarded as related with higher functions. At any rate, various lower animals do not possess any truly supragranular tissue whatever, and possibly this fact is as good an index of their "inferiority" as any other.

Now it is clear that the corticospinal neurone (giant pyramid, or Betz-cell neurone) is in some ways the most important neurone in the precentral (motor) gyrus, since it is, as it were, the discharging neurone of said gyrus. If any impulses whatever can arrive at the corticospinal neurones, then some sort of action must result provided that the lower mechanisms are intact. Some sort of action or defensive maneuver, whether of extension or flexion, whether a blow or a tremor, locomotion or static posture, must result. Let, however, the Betz cells be destroyed and the impulses that arrive or are initiated within the gyrus will fail of their effect, or will secure an effect through very devious paths. How important, then, may it well be to the economy of the organism that of all the cells of the gyrus the giant cells shall possess the highest index of resistance! This the Betz cells seem to possess, at least so far as the fragmentary data now available can prove the point.

Let us now contrast conditions in the cerebral cortex with the somewhat simpler conditions of the cerebellar cortex. Fig. 2 deals with the much simplified neurone supply of the cerebellar cortex following some of the ideas of Ramón y Cajal. If we suppose that impulses arrive in the cerebellar lamina by way of the climbing fibers or moss fibers of Cajal, it is an easy speculation to conceive that far more fixed and habitual reactions may be secured by way of the direct effects of the climbing fibers rather than by the mediated effects of the moss fibers. For the moss fiber neurones must by hypothesis send their impulse to the Purkinje cells by way of the granule cells.



Frederick B. Gay, M.D.
Bacteriologist, 1906–1907.

Herman M. Adler, M.D.
Pathologist, 1909–1912.

Earl D. Bond, M.D.
Clinical Director and Pathologist, 1912–1913.

On the score of function, it would seem that the giant cell of the cerebral cortex and the Purkinje cell of the cerebellar cortex must be homologous cells and together regarded as the discharging cells of their respective neurone complexes. It would be natural to suppose, then, that nature's neural economy might best be conserved by the maintenance of the Purkinje cells at a high index of resistance. Why should not the Betz cells and the Purkinje cells possess approximately identical indices of resistance?

Much research needs to be done along the indicated line, and it is clear that the earliest researches to be completed along these lines would very possibly deal with other elements roughly approximating in size the Betz cells and Purkinje cells. I do not wish to maintain that under all conditions which might be imagined the Betz cell is more resistant than the Purkinje cell. There may very well be differential physicochemical conditions in which the Betz cell would prove to be less resistant than the Purkinje cell. Nor is it my purpose here to explain in detail the evidence for the particular contention concerning the respective viabilities of these two cell types. The point has been sufficiently emphasized that there may exist such differential viabilities of important nerve cell types.

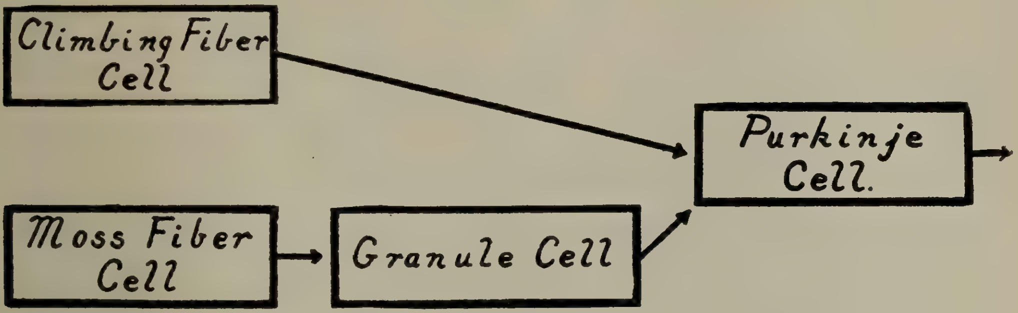


FIG. 2. — Neurone supply of cortex cerebelli.

A word more as to the functional interest of the demonstration of such viabilities. There seems to be little doubt that the supragranular (suprastellate) tissues are the point of attack in many cases of epilepsy. As I tried to express the matter in 1908, "The outer nerve layers tend, so to say, to *weather out* more readily than do the inner layers when under virtually the same conditions with respect to noxious agent." A number of cases in the study of gliosis in acquired epilepsy seem to support the conception that tissue destruction to a moderate degree may frequently leave the discharging apparatus intact when the inhibitory and controlling apparatus is destroyed.

If we should simplify (or as I now prefer to say "decomplicate") the tissue, we bring about the conditions for unimpeded discharge (a phrase of Hughlings Jackson). In the progress of convolutional atrophy in certain cases of epilepsy, the best conditions for lateral discharge from cell to cell seem to be produced so that we may well imagine that we may fail to demonstrate the existence of sufficient dendritic connections between the intact giant cells so that favorable conditions are produced for the so-called "march of convulsions."

Seeing that the small cells of the cortex have been removed by a process of "decomplication" and the phylogenetically older cells, the Betz cells, remain working, the precise condition is afforded for a sort of automatization of the cortex. In later work in connection with a study of the optic thalamus, I spoke of the simplification of the cortical tissues found in various cases of organic epilepsy as favorable to the march of convulsions, and spoke of the tissues as reduced to conditions not much more complex than those which prevail, say, in the spinal cord. "Impulses once initiated in the neurones of such a spinalized cortex ran off with the speed and inevitability of spinal impulses when upper inhibitors are cut off, and a kind of hyperkinesis, namely, the epileptic attack, ensues." To be sure, a great number of adjuvant hypotheses are necessary to the full explanation of epilepsy. Still, if the agents that simplify or "decomplicate" the convolutions in epilepsy were to simplify by means of destroying the Betz cells, or even by destroying all possibility of functional communication between Betz cells, then epilepsy might not exist. If the sort of thing were going on in the cerebral cortex which seems to go on under identical conditions in the cerebellar cortex, then, by hypothesis, under these conditions epilepsy might not exist.

Let us turn to the cerebellar situation. Here, as we have stated, it is a familiar fact that the Purkinje cell layer is a *locus minoris resistentiæ*. As I pointed out in 1905, the macerating cerebellum in edema tends to split along this layer. There is in tuberculous meningitis and in epidemic cerebrospinal meningitis often considerable cell débris and edema in the layer. In tuberculous meningitis we not seldom find a focal destruction of Purkinje cells together with a loosening of structures adjacent, and in ischemic injury to the lamina, we may find a line of neuroglia cells in and near the Purkinje belt, as the only sign of reaction for a considerable distance on either side of the layer. A case of typhoid fever with small hemorrhages in the cerebellar pia mater, published in the granule layer study of 1907, offered a natural experiment to prove both the maximum lability of the Purkinje cells and the initial neuroglia activity of the Purkinje cell belt. Pictures consistent with these descriptions have been found from time to time in work since those earlier publications. Evidence seems to prove that in a great number and variety of conditions, particular laminæ of the cerebellum may be entirely closed off from neural function through the death of Purkinje cells despite the persistence of the other smaller cells of the lamina. It would seem that of two lesions which seem to decomplicate the cerebral and cerebellar cortex equally, the one leaves the Betz cells intact and the other destroys the Purkinje cells. The decomplication in the one case reduces the cerebral cortex to conditions of an automatic machine by a process we have named "spinalization;" in the other case, cerebellar function is "bottled up" through the destruction of the discharging elements of the lamina.

Of what advantage this distinction might be to the organism, it would be premature to say much. Nevertheless, it might be said that it would be of some general survival advantage to the organisms to preserve its Betz cells as long as possible, even if the remainder of the cortical apparatus were reduced to archaic conditions. In the case of the cerebellum, on the other hand, it might well be asked whether the function of the total neural mechanism might not be still more unfavorably affected if the Purkinje cells were to persist when the granule cells were dead. The cerebellum in that event might seriously perturb the action of the neural mechanism by throwing unfortunate tonic, sthenic, and metric factors into a given functional situation. It seems to be generally thought that the cerebrum can get on fairly well without the cerebellum, and that in the higher organisms at least the cerebellum is of lesser value taken by itself. If the cerebrum has more of a function with respect to the sequence and succession of muscular events, then the cerebellum has more to do with the pattern and simultaneous correlation of muscular activity (tone, intensiveness, co-ordination, and the like). But if we may go further and say that the cerebrum is itself also capable of undertaking with fair success the duties of co-ordination in space, then it is clear that the cerebellum is more of an adjuvant of the cerebrum than the cerebrum to the cerebellum. If this account is approximately true, then it might be of evolutionary value that the Purkinje cell should be blotted out under precisely the same conditions in which the Betz cell should be maintained.

We may add another point if we like to the effect that, so far as we know now, the cerebellar cortex is almost entirely uniform in its general structure throughout, and that at present no means exist of telling one lamina from another. If this is the case, then a gradual cerebellar destruction involving the Purkinje cells of a lamina or two might not interfere with the proper workings of the tonic and sthenic functions of the cerebellar cortex; for if only the Purkinje cells of a lamina are placed *hors de combat,* then by lateral conduction through numerous intact cell connections, impulses might reach intact Purkinje cells and thereby reach the dentate nucleus to be distributed safely enough to proper destinations. Perhaps, however, this latter speculation would better be entirely suppressed at the present time.

Enough has been said to show that neuropathological research —

1. Might do well to engage on a program of studying by available methods the differential viabilities of the various nerve cell types, thereby erecting an essentially "pathological" classification of nerve cells on the basis of their powers of resistance or survival values; and

2. Might endeavor to collect data as to the differential effects of simplification or "decomplication" of nerve tissues, having in mind the evolutionary or survival values of the functions which different forms of decomplication would destroy or leave intact.

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DIAGNOSIS PER EXCLUSIONEM IN ORDINE: GENERAL AND PSYCHIATRIC REMARKS.*

By E. E. Southard, M.D.

Abstract.

Table of process-types of diagnosis.
Remarks on these types.
Absence of indicator symptoms in mental disease.
Diagnosis *per exclusionem in ordine.*
Eleven great groups of mental diseases.
Summary.

The General Theory of Clinical Diagnosis.

Is there any excuse for a communication on the general theory of clinical diagnosis? Should not one in the present concrete state of medicine apologize for any generalization or theoretical handling of a topic which has long since passed into the realm of the dead? If medical schools rarely nowadays and only as a *curiosum* deal with the sometime familiar discipline of so-called medical propædeutics and the logic of medicine, is it not for the very good reason that medicine no longer requires any propædeutics or any special overhauling of its logic?

I have two possibly tenuous excuses for the attempted resurrection, namely, first, that it is a canon of mental hygiene to get in imagination as far away as possible from our terrible environment; and secondly, that the realm of dead notions somewhat well befits a pathologist who has gone into psychiatry.

Speaking to a group of eminent clinicians, I need not insist that I myself make no claims to being a diagnostician of the first water. But just as more or less valuable books on elocution are written by persons without color or pretence of oratory, so perhaps one who is not an especially good diagnostician may descant humbly on the matter. Some five years ago, when I became director of the newly founded Psychopathic Hospital in Boston, it became for the first time my duty to deal concretely with a large series of clinical diagnoses. To be sure, before that time, and in fact, in the year 1909, I had been charged with the task of supervising the clinical and pathological research work of the State institutions for the insane of Massachusetts, and had already at that time begun to agitate upon the manifest errors in diagnosis which appeared in a small but definite minority of cases of mental disease in these institutions, as tested by the stern criteria of the autopsy table. I took an especial interest in errors of diagnosis in that mental disease entity about which we know the most, namely, general paresis,[1] and found that one of the most active and thoroughly educated State hospital staffs in the country, namely, that of the Danvers State Hospital,[2] was none the less able to make an error of anywhere from 5 to 15 per cent., according to the fineness of the criteria adopted in the disease general paresis. After all, this work and sundry other articles by my associates and myself[3,4,5,6] remained quite upon the theoretical or unapplied level.

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* Read at the thirty-third annual meeting of the Association of American Physicians, Atlantic City, N. J., May, 1918.

Suddenly, in 1912, I was translated to a region in which exceedingly rapid, not to say provisional, or not to say "snap" diagnoses had to be rendered in what almost any one would concede was the most difficult field of clinical diagnosis, namely, the diagnosis of mental disease. When it is remembered that the task at the Psychopathic Hospital is largely the temporary care of acute, incipient and curable cases, together with a consideration of all the most dubious cases in the community,[7] it will be seen that the problem of a reasonably accurate diagnosis in these cases is not at all easy. It is necessary to remember, also, that our task is not that of the alienist so much as that of the psychiatrist, employing these terms in the differential sense recently advocated in a paper on the nomenclature of mental hygiene.[8] It is not the task of the Psychopathic Hospital to determine, except in a minority of cases, the committability or survivability of its patients. Of the first 5,000 discharges from the Psychopathic Hospital, over 1,700 were discharged as "not insane," a term which signifies not that the patients had recovered, but that they were regarded as not having been insane during their stay at the hospital (the recoveries are over and above the 1,700 not insane). In short, the task here is one of securing a basis for treatment and counsel for cases that lie often entirely without the purview of governmental control as mechanized by the probate courts. A large part of our problem is medical in the strict sense, and not medicolegal.

I may be pardoned for insisting upon this peculiar and almost unique feature of the Psychopathic Hospital work in Boston, because not even my colleagues in the specialty of mental diseases have readily grasped the point. Alienists are a type of physician specializing in medicolegal practice, and their task is to determine alienation, that is, the theoretical or practical committability of their cases in the interest of the public welfare. Psychiatrists are a type of physician specializing in mental diseases on a much broader basis, namely, the basis of finer diagnoses, involving groups of mental disease and defect, and the psychopathic trends which fall short of defined psychoses and even the quicksand topics of eccentricity, crankiness, and oddity. Alienistics — a medicolegal field — is pretty sharply distinguished from practical psychiatry, — a medical field. A good psychiatrist ought to be able to accommodate himself to governmental groups well enough to be a good alienist; but, on the other hand, many a good alienist, who has dealt for years with the category of committability only, is unable quite to see the point of a diagnosis of "psychotic, not insane," or of "psychopathic, not insane." The question of nomenclature is subordinate; but aside from the question of nomenclature, if the practitioner cannot grasp the distinction between insanity in the medicolegal sense and mental disease in the medical sense, he is a man unable to keep pace with the modern progress in psychiatry.

What, we may ask, has the question of psychopathic hospital diagnosis of psychoses that fall short of insanity to do with the topic assigned for this communication? How does this work fit into a discussion of the general theory of clinical diagnosis? Psychiatrists have always taken a good deal of interest in classification. I will remind you only of the eminent instance of Pinel, who, in 1809, published a *nosographia methodica,* which is one of the best known of the old nosologies, a very good general view of which is given in Hosack's publication in 1819.[9] I am afraid, however, that most modern practitioners, and especially in America, would be apt to deride it as out of date, if not fundamentally beside the point of these adventures in classification. Of course these scoffers have the entire interest of science against them in their scoffing. But the modern, practical fellow, especially the pragmatic American, little recks such a small matter as a consistency with the general history of science. Nor will I attempt to defend the various excesses of nomenclature to which my psychiatric superiors, both in point of time and in point of capacity, have sometimes perpetrated. It is another queer way which Americans (and I suspect other moderns) have, namely, to confuse the topic of nomenclature with the topic of classification. Classifying for these persons means assigning a name. To be sure, a slight re-reading of that apostle of clarity, John Stuart Mill, would perhaps set these confused minds aright. Still I suppose it is too much to ask of them to re-read even a few chapters of Mill's "System of Logic."

What, after all, constitutes diagnosis? I do not know whether the Harvard Medical School curriculum is less logical than those of other medical schools that the American Medical Association terms Class A, but it is very hard to get from a Harvard Medical School student at any stage, even immediately after securing his M.D., an adequate definition of the terms diagnosis, symptom, and the like. Yet would any one of us suppose that these terms can be safely dispensed with in practice or in theory? And even if you could somehow show that a pragmatic view of medicine might throw overboard altogether the distinction between disease entity and disease symptom, nevertheless the books are full of these terms used in a variety of ways, and I am sure it ought to be the duty of every medical course to offer some pabulum (whether propædeutic or by way of appendix) on these matters, which were doubtless comprised in the forgotten and discounted field of so-called medical logic.

Many a favorite textbook in the practice of medicine fails to make any point whatever of this distinction, and plumps one forthwith into a discussion, *e.g.*, of typhoid fever, jauntily assuming that the student somehow knows by intuition the meanings of the terms, definition, entity, diagnosis, symptom, symptom complex, syndrome, and the like. Perhaps, however, it is better to leave out general remarks in this direction than to put in some which are found in certain other textbooks that have run into many editions. Strümpell[10] makes no special point of the matter, but insists in a preliminary note upon the importance of diagnosis, of clinical observation, and of keeping the common courses of all diseases in mind. Here, perhaps, is the most commonplace remark nowadays about diagnosis: diagnosis, namely, is constituted by observation, according to these authors. In fact, there is one textbook (Wilson[11]) that summarily states upon its title-page that the whole art of medicine is in observation. On a later page it is insisted not quite so broadly that "it is certainly true that the art of diagnosis is an art of observation;" and, again, "the facts of pathology and semiology and the natural history of the diseases constitute the basis of diagnosis." This latter statement seems almost equivalent to the statement that the facts of disease are the basis of diagnosis, which may be in one sense true, but is so little helpful that it might well be left unsaid. Another recent author (Hall[12]) states that "the art of diagnosis consists, then, in gathering all accessible data and arriving at that conclusion which seems the most reasonable as the probable cause of the trouble." This definition evidently goes beyond the former, namely, "diagnosis is constituted by observation," by considering that the reason is necessary over and above observation. Put in these terms, of course, no one of us would care to say that diagnosis consists in gathering data. Put baldly, it is certainly untrue to say that the collecting of facts constitutes the art of distinguishing amongst these facts. Yet the whole trend of recent work runs in the direction of insisting upon observation at the expense of reason. And whether or no we teachers are entirely clear in our own minds as to the distinction between diagnosis and the mere recognition of facts as such, certainly our students are not always clear. A student will give the diagnosis fever or rose spot, when he would scoff at making the diagnosis, "It is raining," or "The engine is skipping." If this be diagnosis, make the most of it! Of course, diagnosis is clearly a form of recognition, a form of knowledge, but there seems to be no warrant in raising every elementary form of awareness, kenning, or recognition to the level of diagnosis, which term bears within itself a manifest prefix suggesting distinction, differentiation, sundering. All my own medical teachers, and I do not doubt the majority of those of my listeners, insisted upon the value of accurate observation; few of them insisted upon the importance of correct reasoning. Most of them, I take it, partly as a matter of self-defence as they were growing older, were quite sure that maturity of judgment was a thing not readily attained. It never seemed to occur to these teachers that as the powers of observation were on the wane, the powers of right judgment were to increase. In brief, these teachers, without ever once using the term logic, and hardly ever the term reason, managed to get into their homilies for students the idea that there was something besides observation, namely, what they called common sense or knowledge of fundamentals, or keeping essential cases in mind, or ripeness of clinical experience, and the like.

Though I believe some course in propædeutics might well be constructed to contain the main principles of the logic of medicine, yet that is not the point of the present argument. Basing my notion upon the practical experience of the last few years, in which I have had contact with clinical diagnosis, always with the autopsy criterion more or less consciously in mind, I want to argue for a more extensive application of the principle of logic in practical diagnosis, and especially the practical diagnosis of the tyro. Perhaps you will think my argument is nothing more or less than a rehabilitation of the diagnosis by exclusion of the older authors. To some extent, the argument does follow that line, though the arguments have been derived from recent practical experience in offhand and professional diagnosis, and from certain logical considerations. That older argument is found very well expressed in DaCosta's book so long ago as 1864.[13] DaCosta's book, according to an enthusiastic Philadelphian (Wilson[11]), marked an epoch in the progress of internal medicine; and surely many of DaCosta's distinctions are found in several textbooks built upon the lines of his book for many decades after 1864. DaCosta distinguished direct and indirect diagnosis. Indirect diagnosis by exclusion, according to DaCosta, "is not on ordinary occasions much employed *nor indeed is it to be recommended*" (italics mine). It is this dictum of DaCosta which I would think ought to be combated in any summing up of present-day processes in diagnosis.

The reasons why DaCosta felt that diagnosis by exclusion was not to be recommended were assigned by him as follows: first, "to prove what a thing is by proving all that it is not, is a very tedious process;" secondly, DaCosta went on to say, "it is difficult to think of all the possibilities;" and thirdly, he said, "pathology is in an imperfect state." Now, as for the latter two reasons, it is clear that the process of direct diagnosis is equally subject to the pitfalls of imperfect pathology, and equally subject to the charge that it is hard to think of all the possibilities. I myself can only believe that these two latter so-called drawbacks are not drawbacks worse for diagnosis by exclusion than for any other form of diagnosis. Accordingly, I believe that DaCosta's objection to diagnosis by exclusion reduces to tediousness; but should we hesitate to say to our students that it is better to be tedious than wrong? The technique of DaCosta's process may be elicited in his own words:

> To cite a case in illustration. A person consults us for a cough brought on by exposure. He has been sick for four or five days, having been previously in good health. We notice, on examining him, that his breathing is hurried, and that he has fever; the lower portion of one side of the

chest is dull on percussion, and the respiration there is wanting; the action and sounds of the heart are normal. The facts point to the lung or its covering as the seat of the disorder. We know, furthermore, from the history and the febrile symptoms, that we have to deal with an acute affection. What are the acute pulmonary affections? Acute bronchitis; acute phthisis; acute pleurisy; acute pneumonia. In all there is fever, cough, and impaired breathing. Is it acute pneumonia? No; for notwithstanding there is in this complaint, in addition to the general symptoms mentioned, dullness on percussion, such as we have here, the dullness is associated with a blowing respiration; whereas in the case before us no respiration is heard. Let us look at the sputum, and see if it is tenacious and rusty colored. It is not; it is thin and frothy. Moreover, the breathing, although hurried, is, when counted, found to be less hurried than it is in inflammation of the lung. But acute pleurisy may explain all the signs. The patient, too, when questioned, states that he had at the onset a sharp pain in his side; and this we are aware takes place in pleurisy. The vocal vibrations, likewise, are noticed to be absent on one side of the chest, which, when carefully measured, is evidently enlarged. This corresponds in all points with what happens in pleurisy in the stage of effusion. The disease is, therefore, acute pleurisy in the stage of effusion. We finish the diagnosis by ascertaining the existence or nonexistence of other maladies, and by taking note of the severity of the complaint; that it has occurred in a young and robust person of good habits; and that the symptomatic fever is very active.

But what is a direct diagnosis, — one not made by exclusion? According to Wilson "a direct diagnosis is made when the history of the case and the clinical phenomena are sufficient to warrant a positive conclusion." Wilson goes on to say that a diagnosis by exclusion differs from differential diagnosis only in scope. Strange as this phrase may sound, it strikes me that there is a good deal of truth concealed in it. I feel that so far from admitting with DaCosta that diagnosis by exclusion is not much employed or to be recommended, practically every diagnosis is by exclusion, whether consciously or unconsciously.

Musser[14] remarks concerning diagnosis that "the data collected are sufficient to warrant a positive conclusion. The direct method is scientific, rational and most practical. It is a process of purely inductive reasoning." I am not sure whether it would not be sounder to say that it is a process of purely deductive reasoning, but modern logicians have conclusively enough proved that practically all reasoning is both inductive and deductive, so that it would not pay to quibble over the claim that direct diagnosis is "a process of purely inductive reasoning." As to the method of diagnosis by exclusion, Musser remarks: "Thus, a symptom group may suggest several diseases; each affection must be passed in review and excluded until one is found which closely corresponds to the data of the case under consideration." In short, it would seem that diagnosis by exclusion is an effect of the *force majeure* of complex and obscure data. The battle is easily won when it is a question of perceiving a symptom and suspecting a disease, whereupon all "the data collected are sufficient to warrant a positive conclusion."

Now, possibly it is the complex and obscure nature of mental disease which has caused me to feel that diagnosis by exclusion is a method that requires rehabilitation in the minds of teachers and in the pages of textbooks. In medicine and biology at large in the middle of the nineteenth century, it was the fashion to denounce speculation and extol observation. So many of the medical and biological sciences depended upon the microscope and the visual process, that nothing was more natural than to see great virtue in observation as compared with the vagaries of the *Naturphilosophie.*[15] We are now so far beyond the range of that old *Naturphilosophie* (unless the idea of Pan-Germanism may be regarded as a remote result thereof) that it should be quite safe to uphold the reason as entitled to a seat beside observation in the process of diagnosis. Applied logic accords to observation its full worth. Secondly, a proper value is assigned to what may be inaccurately summed up in the phrase comparative method. It is the comparative method probably that is being used in diagnosis for the most part at the present day. That is, one picks a symptom, suspects a disease, constructs a supposititious diagnosis, and proceeds to compare it with all the data of memory or reference books. It is all one, whether you pick one symptom, — *e.g.*, the so-called presenting symptom[16] popularized by Richard Cabot, — or assemble a symptom group, the process remains the same, — that of matching the data of the case with some supposititious diagnosis. Now in the field of mental disease probably every one of you has had the experience of matching virtually all the symptoms of a case with the majority of those given in the textbooks for several different mental diseases. In short, the comparative or matching process has been only too successful, and the diagnosis might well be rendered by lot from amongst a not very small group of textbook headings.

Of course, the comparative method involves the use of observation also. The distinction between observational recognition of a condition and the comparative determination of a disease by a direct method is not a mutually exclusive distinction. So, also, in respect to the third method of applied logic, namely, the statistical method. The statistical method requires both observation and comparison, but entails also certain new features. Probably Richard Cabot has popularized the statistical method of diagnosis more than any other recent author. Cabot finds a presenting symptom which becomes to him a lead. This presenting symptom is often something complained of by the patient, but also is often something noted by the physician that the patient did not subjectively recognize. Cabot has founded a differential diagnosis upon a selection of the most common presenting symptoms. He goes on to list the causes of these symptoms by their frequency, and then, to use his picturesque phrase, "follows the symptom home." Following the symptom home means, naturally, employing all manner of comparative and observational methods in addition to the merely statistical one. Nor do I wish to give the impression that Cabot overemphasizes the statistical method in his account. He merely emphasizes it more than most previous authors. Nor would his account fail to insist that observation is indispensable, for he carefully states that diagnoses are missed usually because physical signs are not recognized; that is, for Cabot poor diagnosis is usually a matter of poor observation. But occasionally diagnoses are poor on account of poor reasoning, and Cabot's book is an argument for a more comprehensive grasp of the possibilities of diagnosis. Others may insist upon the recognition of the symptoms and signs by proper methods of observation, and Cabot, like many others, has in other works given an account of these matters along approved lines, but he dreams for the purpose of differential diagnosis of a "cash register of causes." He wants possibilities sifted. He wants clues, radiations and leadings followed out along lines that are essentially statistical. One proceeds from the presenting symptom to the possible causes; from the possible causes to the probable causes; and from the probable causes to the actual cause. In the technique of this determination, Cabot, as is well known, insists upon the statistical configuration of the different conditions in which the various presenting symptoms are found.

Cabot notes that physicians in the matter of differential diagnosis "are very suspicious of any attempt to tabulate their methods of reasoning." He speaks of profiting much by Herbert French's "Index of Diagnosis"[17] (first published in 1912), a book which I find is greatly affected by medical students of my own acquaintance. French claims his index to be an index of main symptoms, though there seems to be no internal evidence in the book just how these main symptoms were selected. French, like Cabot, deals largely, though not exclusively, with symptoms complained of.

It is readily seen that Cabot's ideas (though they would have been readily comprehended by DaCosta in 1864, since they are founded upon the statistical principle which had already been a few decades in vogue in DaCosta's time) would not have appealed especially to him as important in the process of direct diagnosis. Feeling as DaCosta did concerning diagnosis by exclusion as a *dernier ressort,* he would not have seen the compelling value of Cabot's statistical frequency tables for the distribution of symptoms in different conditions. Moreover, it is doubtful whether in 1864 hospital records were so extensively kept as nowadays, despite the fact that intensive records of special cases may have been kept at a relatively higher standard than now prevails in institutions where the real work is done more by internes than by visiting physicians.

The situation, then, is that in some cases what might be called an observational diagnosis can be rendered. Personally, I should feel that the term diagnosis was being prostituted somewhat when the diseased condition is recognized forthwith on the basis of some pathognomic symptom or combination of symptoms. But let the phrase pass; the result of naming the disease and getting a practical basis for treatment is attained by a process of pure observation. The so-called direct method of diagnosis is hardly on a higher plane logically speaking than that of observation in many cases, but in others, and perhaps in the majority of cases, this process of differential diagnosis by the so-called direct method is one of comparison, that is, of matching the phenomena of the disease observed with those of some classical or textbook type. The unduly maligned method of indirect diagnosis, or diagnosis by exclusion, likewise employs comparison inasmuch as it excludes disease after disease by discovering that not enough exists to match the types in question. Having risen, accordingly, from a process of direct recognition (gnosis rather than diagnosis in any logical sense) to a process of somewhat less direct differential diagnosis by a positive matching or a negative excluding process, we finally arrive at a more modern technique of studying the frequency of symptoms in certain large groups of comparatively well-observed cases (the majority of Cabot's tables deal with 250 cases analyzed at the Massachusetts General Hospital). We notice that the process of observation is indispensable throughout. Extreme exactitude of observation is not perhaps so necessary in statistics as in individual cases, at least errors of observation may be assumed to balance themselves to some degree.

Is there no further sharpening of our technique of diagnosis? In the practical handling of the diagnostic problem at the Psychopathic Hospital, in the course of two years' observation I became interested in the fact that where diagnoses were not matters of mere observation and direct differentiation, but where processes of exclusion were necessary, I found muself endeavoring to exclude conditions in a certain definite order. It is this ordinal principle which I believe might constitute an advance in practical diagnosis were it to be insisted upon in still other branches of medicine than psychiatry. I have recently made some endeavor to apply the principle to the situation in clinical neurology, but shall not here mention the results of that inquiry in any detail. After the first two years of offhand and provisional diagnoses at the Psychopathic Hospital, I then considered the matter of exclusion in a definite order for some three years before laying down the order in question (see below). I think it would be presumptuous for any one in any special branch of medicine to draw up a definite order of diagnoses in any other. For example, however convinced I might be that diagnoses in dermatology are actually made consciously or unconsciously by some process of successive exclusion of conditions in a definite order, I should not (as I am far from being a dermatologist) have the slightest ground for suggesting an order for dermatological diagnoses, or a list of conditions to be put in order. Not being an internist in the field of cardiac disease (that is to say, not being in any sense an expert with the electrocardiograph and all the rest), I certainly could not advocate any particular order of diagnosis for heart disease however strongly I might be convinced that such an order must exist.

At this point, I looked into certain works on logic to learn what might be said concerning these different principles of diagnosis, and found in the late Josiah Royce's contribution entitled "The Principle of Order," in the Encyclopedia on Philosophical Sciences, an exposition very much to the point.[18]

I presume that most of us have few memories of logic except the syllogistic logic of such college textbooks as that of Jevons. Some of the older among us will still have used Mill's "System of Logic," or textbooks closely modeled thereupon. The more recent advances in applied logic are a closed book to most college and medical students, but in addition to so-called formal logic used as an irregular discipline in most colleges, there is an applied logic or methodology which deals with the norms of thought as applied to the methods of the special sciences. The formal logic of a book like that of Jevons is only a very subordinate part of logic as at present defined. Royce speaks of the new doctrine as the science of order. This science, he says, is to-day in a very progressive condition, is in some notable respects new, and offers inexhaustible opportunities for future progress. Already in the Socratic and Platonic handling of these topics, the systematic nature of the world's construction, the objectivity of the world permitting inference concerning its various truths and the order that rational processes show, had already become clear. Types, forms and relations are at least as real as the facts of the physical world. Aristotle, Bacon, and, still more importantly, Galileo, made important advances in logic. To-day no one will question that every science in dealing with its facts must employ methods of classification in no wise different from the method used by Socrates in his dialectics. To be sure, a science which uses only methods of classification must now be regarded as a very young science. Botany and zoölogy have long since passed the phase in which classification is the dominant interest. Anthropology, on the other hand, is largely classifying still, though there is some tendency to the development of a higher method of logic, the comparative study of the forms and results of human culture.

Royce mentions that, among the medical sciences, psychiatry is just now emerging from a stage in which the bulk of the science was made up of the classification of cases, symptoms and disorders. Psychiatry is now about to work on a higher plane of methods. The more complex the facts, the harder it is for a science to get beyond this first stage of classification.

What are these higher processes of applied logic? There are mainly two: the method of comparison, and the statistical method. The comparative method compares the corresponding stages in the various processes of products of natural evolution in the science in question, whereas the statistical method uses exact enumerations as the basis of its science. Of course the two methods are not always sharply to be distinguished; whenever one has to compare numerous evolutionary processes, all the results of these processes have to be enumerated. In these instances, however, the statistical method is merely an auxiliary to the comparative method. When, however, we come to such matters as the mortality tables of insurance, the sociology of marriage and divorce, of suicide and crime, or of commerce and industry, we are dealing with topics in which the statistical method is virtually the only one at present available. We study, for instance, how human mortality varies with age; how the science of an organ or an organism follows conditions determined by heredity or environment. As a result of such statistical processes, the statistician becomes able to deal with aggregations or blocks of facts, orders of aggregations which may be treated as units of a higher order.

When sciences become developed still further, these two methods of comparison and statistics are used in a still more intimate manner, combined in a method which Royce terms the "organized combination of theory and experience." By means of the statistical and comparative method we discover laws of nature that have a certain degree of probability, the degrees of which we may trust on the basis of fair samples of the phenomena of the given science. We then construct laws on the basis of hypotheses derived directly from fair samples of fact. Hypotheses thus drawn may be of the simple type directly refutable or directly verifiable by immediate recourse to the facts, or, on the other hand, hypotheses may require much more work for their testing. In fact, the more direct the proof, the more valuable the hypothesis, since the success of the hypothesis would here depend upon the falling in line of vast numbers of facts which on no other basis could be supposed to fall in line. To combine hypothesis, theory and observation we first draw up a hypothesis regarding the constitution or laws of some region of physical fact. Upon the basis of this hypothesis we make an extensive and exact deductive theory as to what ought to be present if the hypothesis is true. "The more extensive, exact and systematic the theory thus made possible proves to be, the larger are the possible samples of the consequences of the hypothesis which are available." We then collect samples of facts by means of observation and experiment, and proceed to compare them with results of our elaborate deductive theory.

The more elaborate and extensive our theory, the larger the range of facts that we can draw upon for comparison. We are not now restricted to noting what proportion of members of a sample have certain characters. On the other hand, if the deductive theory is a highly developed and elaborate one, we shall find that almost any sample available for comparison is minutely verifiable in detail with some part of the original hypothesis. In short, the value of this method depends upon "the exactness, the order, and the systematic character of the concepts in terms of which the hypotheses thus directly tested are defined." It would thus appear from this highly condensed statement of Royce's view that "the organized union of theory with observation requires for its perfection concepts and systems of concepts which permit of precise and extended deductive reasonings." It is surprising how small the samples need to be when it comes to a judgment as to the applicability of a highly complex hypothesis. A few small samples taken from widely separated parts of the system will prove or disprove the virtues of the hypothesis.

Without asserting that medicine is yet in a stage to profit like physics and chemistry from this organized combination of hypothesis, theory and observation, it is clear that many parts of medicine are far beyond the application of mere statistics or of mere comparison, and still farther beyond the modest virtues of pure observation.

Without venturing further at this time into methodology and modern applied logic, it is clear that mere observation, mere comparison of stages, mere enumeration, are not the whole story in any science. If the medical sciences are going to advance in their logic, it is more than likely that their logical advance will take place in the direction of a greater insistence upon order. I hold accordingly that, if Royce's exposition of certain modern developments in logic is a sound one, the next stage of development in medical thinking will be a reduction of its interests more and more to order and system. There is reason to hope that by the reduction of medical as well as any other scientific facts to order systems, a greater and greater success in deduction will be attained. I conclude, therefore, that when I found our process of diagnosis at the Psychopathic Hospital employing more and more the concept of order, I was simply discovering a small fact bobbing upon the big stream of logical advance.

In the light of present knowledge, how almost naïve and childish appears the old dictum that disease is life under altered conditions! Here were but two elements: life on the one hand, and change on the other. Each contains a host of undiscovered undigested facts. How slender a contribution appears the claim that diseases must be instances of either the augmentation, the diminution, or the mere modification without increase or decrease of structures or functions. To be sure, bacteriology shortly yielded a dyadic system of germ on the one hand and host on the other, which for the moment and for a decade or so allowed one to hope that the formula "disease is life under altered conditions" might be simply rendered into "disease is the effect upon an organism of a germ." Then came the contentions of Metchnikoff concerning phagocytosis, and the more complex interrelations of the host with its contained germ.

Shortly, in the nineties, arrived triadic conceptions of the interrelation of the organism, the foreign substance and sundry intermediary bodies; and early in this century was unfolded the still more mysterious situation of anaphylaxis. In short, the problems of medicine are becoming more and more rich and complex, more and more verifiable by small samples of fact taken at widely diverse parts of the system.

The rapid complication of the research situation in medicine at large, as typified especially by the facts of immunology, has its reflection also in the slower moving departments of clinical diagnosis. We see in textbook after textbook insistence on diagnosis as a matter of observation (going back very far, for example, to Baglivi[19]). We then found, as in virtually all the medical textbooks in the latter half of the nineteenth century, a new form of assurance: the diagnostician is not now satisfied with what he calls direct diagnosis.

The aim here is to enroll the case in some definite group of diseases recognized by pathology. The difference between perceiving that this fruit is an orange and scientific recognition of a diagnosis is merely a question of degree. It is not so easy to say that this is a case of typhoid fever as it is to say that this fruit is an orange, because of the more concealed and special nature of the points on which we rest our diagnosis of typhoid fever. The method is one of comparison of certain perceived characters or features with certain signs already known to us as pertaining to certain disease groups. Whether the symptoms are simple, like a friction rub, or complex, like the chemical analysis of a secretion, whether the symptoms are present at the time of examination or are merely anamnestic, from the diagnostic point of view they are speedily divided into pathognomonic symptoms on the one hand and more general ones on the other. The tubercle bacillus or the Argyll-Robertson pupil might be mentioned as examples of pathognomonic symptoms in this broad sense, whereas fever and vomiting would be examples of symptoms which belong in a great number of disease groups. But whatever the kinds of symptoms we recognize, the process of diagnosis appears to be one of comparison of those symptoms that we perceive with such symptoms as we know to characterize a given group of diseases, and upon the discovery that the symptoms of the disease in hand correspond with the symptoms of the disease type which we know from the books or from experience. We draw a conclusion, then, on the basis of similarity of symptoms. We may draw this conclusion from a pathognomonic symptom, which beyond any question indicates the existence of a given disease; or if no pathognomonic symptoms are present, we may ground our diagnosis upon the harmony between the general symptoms in our patient and the symptoms that belong to some described disease; and of course we are throughout well aware how unsuccessful may be a diagnosis based largely on the similarity of general symptoms to those of the books. This method of diagnosis, which we may briefly term the "type-matching" method, is doubtless the one extolled by the older workers under the name direct diagnosis. It represents an advance upon purely observational diagnosis, that is, diagnosis by inspection, and is a form of diagnosis by comparison.

Diagnosis by exclusion or by differentiation is a method somewhat decried by older workers and now brought into great prominence by such work as that of Cabot and of Herbert French. Though there is nothing logically new in this work, there is a new emphasis upon it. It is still, logically speaking, an application of the comparative method greatly bolstered as Cabot handles it by the statistical method.

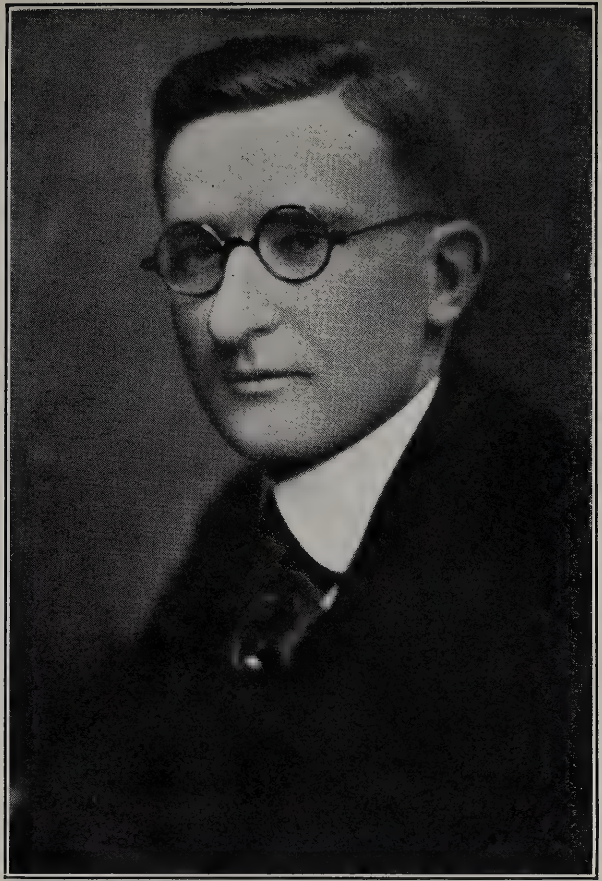
The general nature of differential diagnosis is somewhat as follows: as it is impossible to consider all the phenomena in a given disease, we first select a group of diseases in which a certain sign is found. We look in the case under observation for some more or less outstanding symptom. This common symptom which we would use as the point of comparison amongst diseases is called by Bieganski[20] the index of differentiation, or the difference indicator. Cabot has more recently termed one form of it the presenting symptom. This indicator or presenting symptom is chosen because we by experience know that it occurs in a large number of diseases. To be sure, it is much better not to take a too general indicator. Thus, in the question of typhoid fever, it would not be so advantageous to begin with fever, perhaps, as to begin with diarrhœa. The process of differentiation now begins: we compare the case under observation with those diseases which we have found to be somewhat similar thereto. We pass from one disease group to another. We constantly keep upon one side the observed case with all its symptoms, and on the other the total series of diseases which in a certain respect are similar to it, namely, in respect of the common trait, index of differentiation, or presenting symptom. We proceed to look for differences. The observed case may not belong in a group because it does not possess the symptom which is constant in that group; though the indicator is possessed by both diseases, a symptom constantly present in the compared type is absent in the observed case. Or the observed case may not belong in the compared group because there is a symptom in the observed case which never occurs in the compared group.

Again, the observed case is not the disease with which we are comparing it because we know that in the compared disease a symptom constantly occurs which is the direct opposite of some symptom observed in the case in hand. Moreover, there may be an incongruence of symptoms of a quantitative or qualitative nature, a difference which does not proceed to the point of complete absence or perfect antagonism of symptoms.

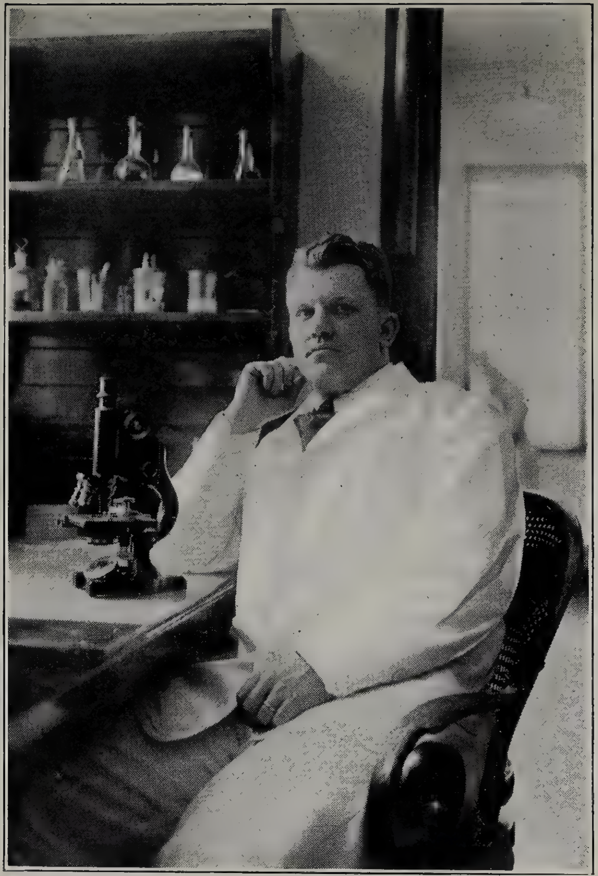
Following is a table which embodies the process types of clinical diagnosis now in vogue: —

Table of Process Types of Diagnosis.

I. Inspection.
II. Expectation.
III. Induction.
IV. Comparison.
    (*a*) Similarity.
    (*b*) Similarity and difference.
    (*c*) Difference.
V. *Ex juvantibus.*
VI. *Ex nocentibus.*



Lawson G. Lowrey, M.D.
Pathologist, 1914–1917.



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Pathologist. Appointed 1918.

I may say at the outset that it is the endeavor of this paper, granting each of the three subordinate methods under the head of comparison to be a separate logical method of diagnosis, to add a ninth method. This ninth method I shall choose to call diagnosis *per exclusionem in ordine*." Diagnosis *per exclusionem in ordine* is merely a method of employing logical comparison of Type IV (*c*) of the above table in an orderly manner.

But before attempting to speak of this newly described type of diagnosis I must briefly describe the eight classical methods so that I may, if possible, demonstrate that the ninth or proposed new method has novelty. For the purposes of this discussion I have gone rapidly over a great many of the older textbooks of medicine, studying largely the logical remarks by their authors in the prefaces and introductions thereto. I then examined many of the textbooks in Medical Logic which were for some years the vogue in medical schools. From the study of textbooks, largely in the latter half of the nineteenth century, and from the study of works on Medical Logic I have arranged and combined the methods of the above table. I have been especially aided by the modern work of Bieganski, a Polish work available to me in German translation from its second edition. This work may be referred to for a good summary of the older points of view, together with the fruits of some Polish polemic in which Bieganski had for some years been engaged. The older work of Oesterlen,[21] published in Tübingen in 1852 and translated into English[22] in the Sydenham Series in 1855, is almost barren for modern purposes (so much so that I found the leaves uncut, both of the original and of the translation, in the New York Academy of Medicine!). Of still older literature, the "Medical Logic" of Sir Gilbert Blane,[23] illustrated by conclusions concerning yellow fever, is of great interest, though his classification of the elementary principles of life as generative, conservative, temperative, assimilative, formative, restorative, motive, sensitive, appetitive and sympathetic, is an example of categories which, however true and, from various points of view, feasible they may be, are of little diagnostic value. This older work often fails to distinguish the question of classification from the question of what is to be classified. Sir Gilbert Blane's work upon yellow fever, and especially upon scurvy, derived from his expert contact with marine diseases in the British West Indian campaigns, is of greater value than his excursions into logic. Blumenbach calls Sir Gilbert Blane the most learned and classical physician of the age, but despite this German appreciation little has been done in Germany of an original nature on medical logic. Oesterlen appears to be in the general nature of a physician's reaction to the logic of John Stuart Mill. Apparently some one was impressed with the possible value of such work as Oesterlen's, and Francis Ogston was given a new chair in Aberdeen as Professor of Medical Logic and Jurisprudence. In a syllabus[24] of his highly interesting course of thirty-two lectures, he refers to his indebtedness to John Stuart Mill and to Oesterlen, traces the history of the topic from Aristotle to Bacon, thence to Blane and Oesterlen, and comments upon the absurd distrust of theory which he found prevailing in Britain. Ogston called the merest routine practitioner a bold speculator and imperfect observer of facts. He remarks that the limits of pure observation in medicine are soon reached, and discusses in separate chapters the inductive or analytic method as opposed to the deductive or synthetic method, rightly holding that the latter is a much more important concern of medicine than the former. Under the inductive or analytic method Ogston considers the processes of observation, comparison and analogy and the numerical method. Under the deductive or synthetic method he considers first the process of analysis for deductive purposes, then the process of ratiocination and of verification. He discusses, among the processes subsidiary to induction, such matters as simple observation, experiment, hypothesis, analogy, the numerical method, terminology and classification. Ogston denounces the current nosologies as obstructive and inelastic and devotes special attention to what he calls the fallacies of nonobservation as opposed to the fallacies of malobservation. Much of this suspicion of Ogston can be traced in Oesterlen and Sir Gilbert Blane, to say nothing of their masters in logic, John Stuart Mill and Sir Francis Bacon.

Sir Gilbert Blane had, for example, in 1819 spoken of the sources of error in medicine as (*a*) the fallacy and danger of hypothetical and theoretical reasoning as especially demonstrated (according to Blane) in Boerhaave, (*b*) the diversity of constitutions, (*c*) the difficulty of "appreciating the salutary efforts of nature and of discriminating them from the operations of art," (*d*) superstition, (*e*) the ambiguity of language, and (*f*) the fallacy of testimony.

Much can still be gained, no doubt, from a perusal of such works as those of Sir Gilbert Blane, Oesterlen and Ogston, and still more could doubtless be gained by the physician from a close study of John Stuart Mill and his predecessors in pure logic, but these studies were almost wholly given over with the onset of the evolutionary theory in the late fifties, with the crowding developments of pathology and physiology and especially of the bacteriology of the eighties and the immunology of the nineties of the last century. There has, in fact, crept over us the feeling that logical method is an inheritance of us all in like degree, and that whatever we do not know of logic at the outset of medical practice we shall never learn. It is precisely the popular single volume textbooks that fail to yield much of practical value to the medical student seeking to perfect himself in the logic of diagnosis. The dictum, especially of DaCosta and of his successors in the manufacture of single volume textbooks, namely, that the art of medicine consists in observation, has apparently abolished the necessity of logic. Carried away by the magic of this word "observation," many authors of physiological works dealing with the most intricate discussions and fine-drawn conclusions cheerfully called their inductions and deductions by the term "observations." The obvious fact is that diagnosis does not consist in observation at all. Diagnosis requires observation, proceeds upon a basis of observation, but is in itself a process of combination, of reasoning, of calculation, or of some higher kind of intellectual process which takes observation for granted, uses and chooses among observations, but in no whit makes them.

Amongst the methods tabulated above I have first set down, following many of the books, diagnosis by inspection. Here, at the outset, it may be inquired: "Are we not terming a method of diagnosis what is nothing but a method of observation?" This I freely concede. The names of diseases are achieved by a process of inspection. The result is what we term a diagnosis, but the process by which the so-called diagnosis or disease name is arrived at is not a process of reasoning at all, but (as stated above) a process akin to the statement, "It is raining," or "The engine is skipping." In short, no process of diagnosis in the logical sense is here being used. A diagnosis or disease name is achieved, but reasoning is not employed. It is only, then, by courtesy that we include inspection under the process types. The diagnosis follows the inspection as night follows day, or as black follows white, or as man follows woman. The process is one of association of a perfectly simple type. This kind of so-called diagnosis can be made by laymen often as well as by physicians. I am afraid that the ideals of many medical teachers, as they are got by the eager students, consist in teaching them thumb rules of inspection rather than the more tedious and complicated methods of diagnosis. I recalled above how DaCosta spoke of diagnosis by exclusion as a tedious method.

The second method tabulated above is one that I have presumed to term the method of diagnosis by expectation. We are familiar with the so-called expectant treatment in therapeutics, but, so far as I know, attention has not been called to the method of diagnosis by expectation. This is, of course, particularly employed in the fulminating acute diseases on one hand and the chronic diseases on the other. In the one instance there may not be facts enough to permit a diagnosis by inspection and there may not be time enough to permit elaborate comparisons; accordingly, diagnosis goes by the board until an autopsy either is or is not made. As for the slow, hesitating course of certain diseases, the Micawber attitude is still easier to assume.

I suspect that the method by induction is commonly employed in a manner not far removed from the process of expectation. This method by induction, unlike the method by expectation, is mentioned in the classical works, and also in the modern work of Bieganski. One concludes that the patient looks tuberculous. Here is the suggestion of a diagnosis by inspection. Perhaps one is an office practitioner and time forbids exactitude. One examines the pulmonary apex and discovers suspicions of dulness. One requests the sputum and proceeds to a positive diagnosis of tuberculosis on the basis of tubercle bacilli found in the sputum. Here is a successful case of diagnosis by induction by a sort of skipping of intermediaries (to use James's phrase) and by the least possible work. If the diagnosis is successful, well and good! If unsuccessful, one must proceed to more elaborate methods. It is always possible, too, that the patient may have been suffering from a combination of two or more diseases and that the tuberculosis, *e.g.*, found may be the lesser of two important conditions. One ought not, and I do not condemn this method by induction just because it is not time-consuming and just because it does not succeed in all cases. In the hands of the expert the method of diagnosis by induction (as the phrase is here used) and the method of diagnosis by inspection are highly commendable methods. In a pragmatic age one ought not to denounce them. From the standpoint of a medical student, however, it would seem wise not to dazzle him with the brilliancies of inspection and induction (in the above narrow sense), but one ought to expound to him the nature of the more complex methods which he must often use in cases that are themselves at all complex.

The methods of diagnosis *ex juvantibus* and *ex nocentibus* tabulated above are in a sense experimental methods of diagnosis on all fours with the method by induction. The diagnosis of syphilis by the administration of antisyphilitic drugs and the procuring of a cure or an alleviation of symptoms is an example of diagnosis *ex juvantibus*. The provocative Wassermann reaction upon the administration of salvarsan is an example of the method of diagnosis *ex nocentibus*. It would be a mistake to consider the administration of drugs for these purposes therapeutic. The methods are methods of diagnosis purely.

Dismissing the methods of inspection, expectation, induction, *ex juvantibus* and *ex nocentibus*, we come to the methods of diagnosis by comparison, to which I hope to point out a small addition or modification which I conceive to be of value. Earlier in my communication I have sufficiently discussed these methods, and I pointed out the necessity under which we labor of using the method of diagnosis by exclusion in cases where there are no indicator symptoms or presenting symptoms (to use Cabot's phrase for certain indicator symptoms). I wish to illustrate this method of diagnosis *per exclusionem in ordine* from the field of mental diseases, rehearsing the main groups of a practical key[25] which has been built up on the basis of Psychopathic Hospital data.

In passing, I may say that psychiatrists are far more at one in the matter of diagnosis than the general medical man is apt to believe. The unanimity in point of view is far greater than one would suspect from certain nomenclatural differences. The nomenclature of psychiatry is by no means as fixed at the present writing as the nomenclature of dermatology. Yet the unanimity of psychiatrists concerning the major groups of mental disease is, I make bold to say, almost as great, if not quite as great, as the unanimity of dermatologists concerning their main groups. The specialists in psychiatry have for some years past been much interested in proposals of the American Medico-

Psychological Association to secure a thorough and acceptable classification of mental diseases to which the State institutions for the custodial insane could conform. The classification adopted by the Medico-Psychological Association in 1917 is, in general, a highly acceptable one.[26] Probably no member of the committee charged with making the classification is entirely satisfied with it in details. Some diagnosticians go so far as to say that in the interest of the patient no classification in the sense of the statistical tables of institutions is worth while, since every instance of mental disease is virtually *sui generis.* There is, of course, much truth in this contention, and the good therapeutist never forgets this fact, borne in upon the mind as it is by the tremendous individual variety of the psychopathic reactions of the individual as such. I found that most of the leading American textbooks of psychiatry were also practically at one in the major categories, despite perturbing difficulties in terminology.

The task of the Psychopathic Hospital, dealing as it does not merely with custodial insane but with all the penumbra of "near insane," of incipient, mild and curable cases, and with many psychoneuroses which would not ordinarily be classed among the insanities, is a somewhat broader and deeper task in diagnosis than that of the custodial institutions for the insane. The Psychopathic Hospital stands as a sort of vestibule between the community and the custodial institutions. From its meshes go back into the community numerous cases whose psychopathia is not far advanced enough to go through the interstices. Not only insanity in the narrow sense, but a variety of other conditions of the *non compos mentis* group, namely, feeble-mindedness, epilepsy, and even many forms of alcoholism come within the purview of the Psychopathic Hospital. The task of rapid diagnosis was one which had never faced the custodial institution for the insane because to the latter flowed only cases in which diagnostic experts had made their decision outside the walls of the institution and with the concurrence of the courts. It became necessary, therefore, to contrive more rapid methods of handling cases than had formerly been available, inasmuch as keen and mature experts were not available for the great run of cases (the Psychopathic Hospital ran the number of voluntary cases and of so-called temporary care group of cases up by the hundreds as soon as it was founded). Some provision had to be made whereby younger men could make reasonably accurate primary siftings of the cases. The rapid development of mental hygiene stole away the young men at such a rate from our staff that provision had to be made for shifting staffs of relatively inexperienced persons. The situation was not unlike that which faced the army itself at the outset of the first draft.

Mental diseases have no indicator symptoms, barring a few, and indeed a very few, so-called pathognomonic symptoms. Psychiatry was devoid of pointers, such as would be available to the specialist in the exanthems, for example. In the absence of indicator symptoms, some method had to be chosen by which every case would have every major hypothesis concerning its nosological grouping raised at some time during his hospital stay. The legal details and official regulations were such that these hypotheses had to be raised within a very short period. Early in our experience the laws and regulations were such that some kind of diagnosis permitting proper disposition of the case had to be made within four or five days. This proved to be too brief a period in which to make proper disposition, and the temporary care law, under which the majority of Psychopathic Hospital cases are admitted for observation directly from the community (without court process), was modified so that a period of seven or eight days is now available. Official disposition is at present made in a total period of ten days instead of in a total period of seven days; but in practice the external conditions of transfer to social adjustment take from two to three days, so that the total time available for group diagnosis is now a period of from seven to eight days. During this period of seven to eight days what can be done?

I assume that in private practice it may not be necessary to secure the Wassermann reaction of the serum in each and every mental case. For my part, I never feel certain of the diagnosis unless this precaution is taken. In any event, in Psychopathic Hospital practice, with the varying conditions of staff and history standard, it shortly proved necessary to get the Wassermann data from the serum in each case. Only a few of the more conservative hospital superintendents failed at first to approve this plan. The Danvers Hospital in Massachusetts and the hospitals in Michigan, under the influence of the psychopathic ward at Ann Arbor, had early adopted getting the Wassermann reaction of the serum as routine. Upon reflection, I found that the proper disposition of almost each and every case depended upon our securing these Wassermann data. If the Wassermann data were dubious, then a longer period of diagnosis was necessary. If the serum proved negative but there were other signs of organic disease of the nervous system, lumbar puncture was resorted to, with the diagnostic hope that the Wassermann reaction and the other reactions of the fluid would prove decisive. The practical disposition of each case I found to depend upon taking the Wassermann reaction of the serum. Accordingly, although there is no indicator symptom which is infallible or anywhere near infallible in the detection of neurosyphilis, the value of the Wassermann reaction of the serum is such that I feel entitled to place the syphilopsychoses, or mental diseases of syphilitic origin, at the head of all diagnostic consideration. This was the beginning of the plan of ordinal exclusion, the plan of diagnosis *per exclusionem in ordine.* The first thing to be excluded in the diagnosis of mental disease was, in short, syphilis.

The second thing to be excluded was, I found in practice, some form of feeble-mindedness. To be sure, the obvious imbeciles and idiots may secure their diagnosis by inspection, and not so much difficulty is ordinarily felt amongst the morons or the feeble-minded proper of the English classification. But when one came to the so-called stupids or subnormals, that we now find to lie between the morons below and the normals above, the value of the Binet-Simon tests or their analogues became extreme. One does not need to claim 100 per cent. values for these tests any more than for many another biological test. The tests are nevertheless of value. I found that in practice I needed to know for every lucid case, that is, for every case which could practically be tested metrically, the intellectual titer. Even were I dealing with such a condition as dementia præcox or manic-depressive psychosis, I nevertheless found that I needed the mental test as a base line.

Thirdly, I found that the hypothesis of epilepsy or epileptic symptoms and of epileptoid phenomena is one very apt to be isolated from consideration by the tyro or even by the expert. I placed epilepsy third in the diagnostic order of exclusion partly because of the relative reliability of the clinical histories in these cases.

After Group I, the syphilopsychoses, Group II, the hypophrenoses (feeble-mindednesses), Group III, the epileptoses, Group IV, the pharmacopsychoses (including mental diseases due to alcohol, drugs and poisons), I come to Group V, the group of mental diseases due to focal brain disease, — the so-called encephalopsychoses. This is the group of cases in which we unconditionally need the data of the routine neurologist's diagnosis. We need to exclude conditions of heightened intracranial pressure and conditions of asymmetry, reflexes and the like, indicating focal brain disease.

Sixthly, after Group V, the encephalopsychoses or neurologist's group, I found that in practice I was asking for the data of the internes, namely, the data which would go to make a diagnosis of a mental disease somewhere in the "symptomatic" group, — Group VI, a group I have termed the somatopsychoses.

After these I tried to exclude presenile and senile phenomena belonging in a group which I have termed, following Nascher's geriatrics, the geriopsychoses (Group VII).

Then come the stock difficulties of diagnosis for the psychiatrist, — the diagnosis of Group VIII, the dementia præcox group, which I like to term (from their main symptom as defined by Bleuler) the schizophrenoses.

After the schizophrenoses stand Group IX, the cyclothymoses, or a group including the manic-depressive psychoses and similar mental diseases.

The last of the ten well-defined groups is the familiar Group X of the psychoneuroses, including the hysterias, neurasthenias and psychasthenias, but if in the diagnostic order of exclusion one could not place one's case in any one of these ten comparatively well-defined groups, one would not throw it altogether out of the psychiatric lists, but would call it a plain psychopathia and put it in Group XI, the psychopathoses.

Following is a table of these major groups: —

Mental Disease Groups (Orders).

I.	Syphilitic, ...	Syphilopsychoses.
II.	Feeble-minded, ...	Hypophrenoses.
III.	Epileptic, ...	Epileptoses.
IV.	Alcoholic, drug, poison, ...	Pharmacopsychoses.
V.	Focal brain ("organic," arteriosclerotic),	Encephalopsychoses.
VI.	Bodily disease ("symptomatic"), . .	Somatopsychoses.
VII.	Senescent, senile, ...	Geriopsychoses.
VIII.	Dementia præcox, paraphrenic, . . .	Schizophrenoses.
IX.	Manic-depressive, cyclothymic, . . .	Cyclothymoses.
X.	Hysteric, psycho, neurasthenic, . . .	Psychoneuroses.
XI.	Psychopathic, paranoiac *et al.*, . . .	Psychopathoses.

I have spoken of the botanical and zoölogical analogues of this grouping in a paper read before the Neurological Association in 1917. Two words of warning are necessary concerning this analogy. The choice of the ending -osis is obviously an attempt to get a medical analogue for the botanical ending -aceæ or -osæ, as in the orders Rosaceæ and Leguminosæ. These botanical orders are, as is well known, susceptible of splitting into genera and species. It would be an entirely superficial objection, for this account, to say that the term "species" has obtained in natural history a very special meaning which could not appropriately be given to a disease. Biologically speaking, a species is sometimes taken to mean such a group of plants or animals as are capable of breeding true to type. However, the genus-species distinction is a great deal older than natural history and is used throughout every province of logical classification known. For example, the mineral kingdom, though without process of breeding, is in part susceptible to a classification of the genus-species sort. For that matter, it is not necessary to use the terms order, genus and species for these groupings at all. One might use entirely other distinctions and still the process of classification might be entirely valid.

The other point which should be made is a kindred one. In zoölogy and botany one would ordinarily be satisfied if in the process of logical exclusion one arrived at the animal or plant which fulfilled the conditions of differentiation, but in the process of diagnosis *per exclusionem in ordine* as applied to mental disease one unconditionally needs to go through the entire list in each case.

For example, one might easily face an instance of mental disease such that the victim was a syphilitic, feeble-minded, epileptic, alcoholic old man, with focal brain disease and somatic disease, the whole contributing to his mental picture. He might conceivably have been psychoneurotic or cyclothymic in his life, for these conditions are doubtless consistent with a fundamental feeble-mindedness in some cases. Whether he could also have been a victim of schizophrenia (dementia præcox) and still have mental phenomena attributable to all these other groups is a question. We are aware of cases that start by being feeble-minded and apparently have their schizophrenic process grafted upon them, but whether these combinations of psychoses in so multiplex a form are common or really exist is not my point. Combinations of two or three of these conditions are not in-

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frequent. It is, therefore, stringently necessary, in the rough analysis of psychiatric cases, to make all of these major hypotheses and dismiss them or fix upon them one by one. In short, diagnosis *per exclusionem in ordine* does not necessarily exclude ten out of the eleven groups, but it does endeavor to exclude each one of at least ten of the groups. If the process has succeeded in excluding the first ten, the case, if psychiatric at all, must remain in the unresolved or ragbag group of psychopathias, Group XI, the psychopathoses. I do not intend here to enter the minutiæ of psychiatric diagnosis, although in another place I have made some endeavor to describe the main genera and species of the groups above tabulated.[27] Incidentally, I have endeavored to place genera and species in the same sort of practical order, so that the tyro may consider the diagnosis of the species of syphilitic, hypophrenic and other forms of disease in arbitrary order.

It is scarcely necessary for me to insist that I do not attach great consequence to there being ten or eleven more or less major groups of mental disease. In fact, I insist that the future must interpolate or extrapolate *re* these groups. The groups are not groups based upon clinical resemblances alone, upon anatomical disease, or upon etiology. They are practical groups devised upon what has been found to be the best practical order of exclusion of major groups of mental disease, each seeming to require a special form of handling. I have described the method in my paper entitled "A Key to the Practical Grouping of Mental Diseases." I am not sure that I would not be warranted in using the term pragmatic instead of practical, for the end name of these groupings is, after all, a therapeutic one. The basis for these rough distinctions is a question of disposal of the patient. If the patient belongs amongst the syphilopsychoses, then antisyphilitic therapy is indicated, or at least must be thought of. If the patient is hypophrenic, then a school for the feeble-minded, an institutional equivalent, or some form of supervision looking to the safeguarding of the community and the development of the case must be adopted. If the case is epileptic, certain special safeguards are necessary; whether the case is an alcoholic epileptic or a traumatic epileptic. The etiology and the anatomy are not at all so much to the point as the practical handling of the epileptic. So, too, with the alcohol and drug cases. In fact, the practical consequences of placing one's patient in one of the first four groups of syphilitic, hypophrenic, epileptic and alcohol or drug cases are such that I think on these practical grounds alone it would be wise for the diagnostician to consider syphilis, feeble-mindedness, epilepsy and alcohol, drugs and poisons before he comes to the minutiæ. He will thus get settled in his mind many of the practical social questions of a legal, institutional and social service nature. Take the group of mental diseases due to focal brain disease. Should the phenomena of the present war show us that the traumatic psychoses, that is, psychoses due to structural brain disorder, form a practical group on a level of practical interest equal to that of the listed groups, I for one should have no objection to raising these traumatic psychoses, which I at present place under the encephalopsychoses, to a higher dignity, namely, that of the traumatopsychoses. For the moment, I seem to feel, and I suppose most of my colleagues would agree with me, that the traumatic psychoses rather resemble genera under the focal brain disease group than the true great orders of disease. Let the list be telescoped or accordeonized as you will, no damage is done to the concept value of the greater groups of mental disease.

Again, should some one wish to consider the somatopsychoses ahead of the focal brain disease group and exclude, *e.g.*, pellagra and cardiorenal disease from a rôle in the given patient ahead of brain abcess, brain tumor, arteriosclerosis, and the like, I should have no objection. The point I make is that some order, not any particular order, is desirable for the tyro in diagnosis. I insist, therefore, on no particular great groups, but on the principle that there should be great pragmatic groups of mental disease analogous to the orders of botany. I insist, again, on no particular order of exclusion, but on some order of exclusion of these groups, and above all, I insist upon subjecting each mental case, so long as indicator symptoms are so woefully absent, to the hypothesis of his possibly belonging under every one of these great groups. Indeed, I feel that he may belong in two or more of these groups.

Whither, you may ask, does the pragmatic principle then disappear? Suppose a man is both epileptic and alcoholic; shall we classify him as in the group of epileptoses or in the group of the pharmacopsychoses? All specialists will remember acrimonious discussions of this nature. Are we dealing with epilepsy or with alcoholism, or with both? Now, I find that in practice, if you couch the question pragmatically, there is rarely, if ever, any doubt into what group you wish to throw your case. Once you put the question thus: Do you wish to send this case to an institution for epileptics or do you wish to put him in an institution for alcoholics or under appropriate supervision suitable for alcoholics, there is almost never any doubt on the part of the careful physician whether his case is a case for an institution for epileptics or a case for an institution for alcoholics. The pragmatic question is forthwith settled. The academic question, whether one is an epileptic alcoholic or an alcoholic epileptic becomes a vividly practical question when the pragmatic, that is to say, the therapeutic, question is raised. I find that this kind of consideration matures the tyro in psychiatry very fast.

SUMMARY.

1. The writer apologizes for a communication on medical logic in general when he is only a psychiatrist and but recently a pathologist. His excuse is the necessity for reasonably accurate snap diagnosis in the sifting problem of the psychoses, psychoneuroses and psychopathias, as they flow through the Psychopathic Hospital clinic in Boston.

2. The medical student is found destitute of the ability to define entities and symptoms. The textbooks in medicine, especially the single volume textbooks, rather tend to make the student believe that diagnosis is observation. In point of fact, diagnosis is not observation, though it requires and indeed stands or falls by accurate observation.

3. DaCosta and his successors have lauded so-called direct diagnosis to the skies and DaCosta rather decried indirect diagnosis by exclusion as a tedious process. An example is cited from DaCosta which shows how relatively simple the classical diagnoses of general medicine are beside those of psychiatry.

4. It seemed that diagnosis by exclusion ought to be rehabilitated. An examination of recent research work in logic indicated that higher and more complex methods than those of observation had become necessary in science. For example, Cabot and Herbert French have attempted to profit by the statistical method, which again, though it requires reasonably accurate observation, is not in itself a method of observation at all. Yet Cabot's statistical frequency tables possess a certain diagnostic value. But the student is often misled by the brilliancies of so-called observational diagnosis in a clinic.

Here diagnoses are often rendered on inspection by a process akin to the recognition of a fruit as an orange, or an automobile trouble as "the engine is skipping." This process is not diagnosis, it is a process of recognition that may receive a simpler term gnosis.

5. The offhand snap diagnostic work at the Psychopathic Hospital indicated that we were in practice relying upon the successive exclusion of certain great disease groups in a certain definite order.

6. A study of Royce's "Summary of Recent Researches in Logic" shows how an organized combination of theory and experience is the higher logic to which the more complicated sciences must resort. Royce himself mentioned psychiatry as a science about to climb out of the classifying era into the era of logical order, that is, of the organized combination of theory and experience. Such a dictum that "disease is life under altered conditions" appears now childishly simple. The idea that disease is a matter of an organism plus a germ was found to be altogether too simple when in the nineties of the last century the concepts of immunology were developed.

7. Those departments of medicine in which the presenting symptom of Richard Cabot is of value are lucky departments. Those departments of medicine in which the indices of disease or indicator symptoms of the elder writers are available are also fortunate departments in comparison with psychiatry. In mental disease there are exceedingly few indicator symptoms.

8. Hence the need became apparent of a process of exclusion of great groups or phenomena in a certain definite order, so that nothing of large significance should evade consideration. To avoid the tediousness of exclusion, complained of by DaCosta, the phenomena of disease had to be logically grouped in certain great groups, and the process types of diagnosis in the books may be counted as six or eight, according to definition.

9. In the body of the paper, a special statement was made about each of these process types: inspection (regarded as not really diagnosis but as merely recognition of gnosis); expectation, a newly named but frequent method (far older than Micawber); induction, *ex juvantibus, ex nocentibus* (three methods in which in no very rigorous way experiment is used); and these three methods of diagnosis by comparison are successively discussed.

10. The ninth method, diagnosis *per exclusionem in ordine,* is

in one sense a minor modification of the old method of diagnosis by exclusion. It is of value in departments of medicine where there are no indicator symptoms, and where the so-called presenting symptom would merely indicate some kind of mental disease.

11. The general application of the method of diagnosis *per exclusionem in ordine* in the field of mental disease is demonstrated in the eleventh group of mental diseases into which most of the phenomena may be pragmatically cast. The groupings are not by clinical resemblances, by anatomical attack or by etiology. The distinction is a pragmatic and therapeutic one and will naturally tend to become more and more etiologic as the causes are determined. But in the field of mental disease, causes are so apt either to be unknown or to be multiple that etiologic classification on any simple basis, such as that of the infectious diseases, is practically inconceivable.

12. It is hoped that other departments of medicine (where diagnosis is raised above the level of mere recognition and there are few or no pathognomonic or indicator symptoms) will find it to their advantage to set up a method of diagnosis *per exclusionem in ordine*, the great groups or orders being always determined on a pragmatic basis. In the body of the paper are given the general designations of the ten great groups of mental diseases, with the eleventh residual group.

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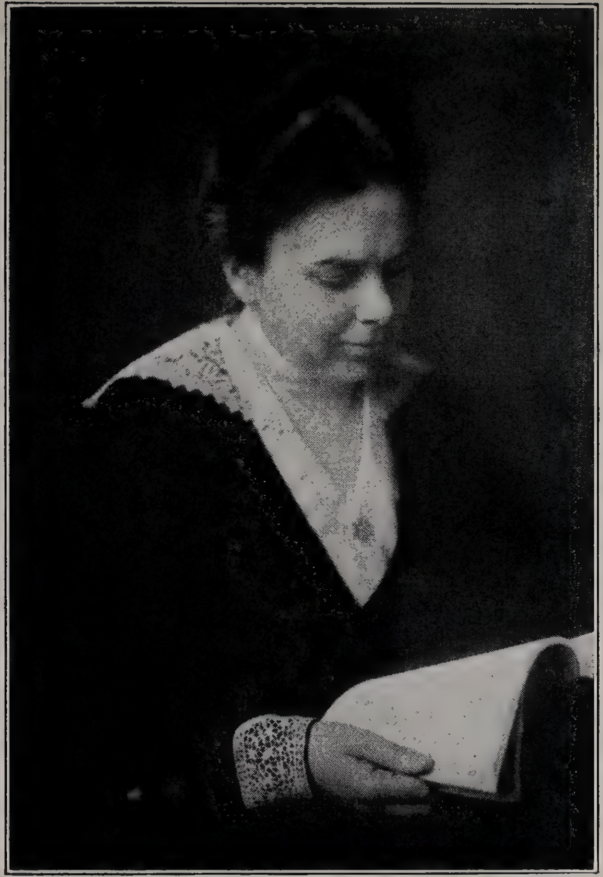
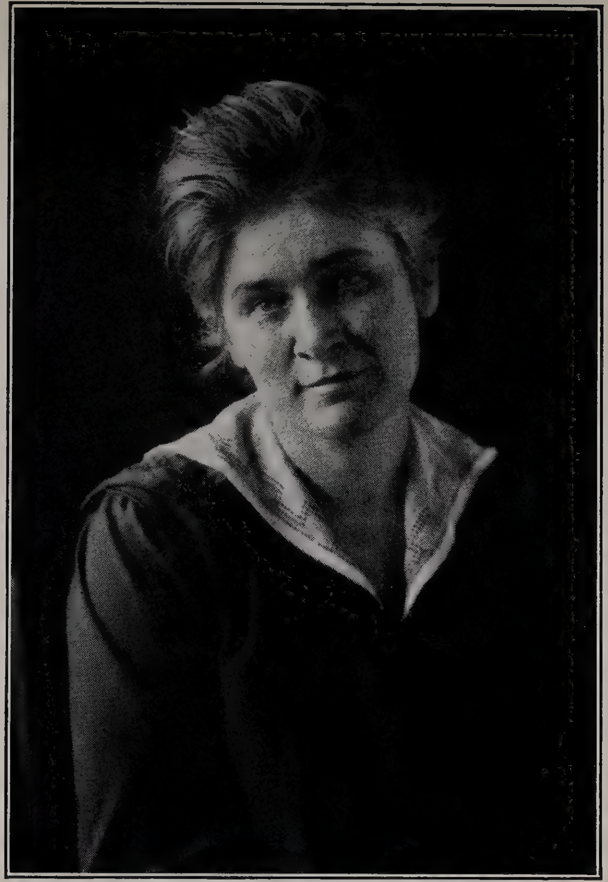


Anna H. Peabody, M.D.

Assistant Physician and Assistant to the Pathologist, 1906–1913.

CAT.



Myrtelle M. Canavan, M.D.

Assistant to the Pathologist, 1907–1910.

OBSERVATIONS ON CRANIAL ASYMMETRY.

By Herman M. Adler, M.D.

In 1909, when the writer assumed his duties as pathologist and assistant physician at the Danvers State Hospital, he was struck by a seeming coincidence in the appearance of the patients who were presented at the daily staff meetings. It seemed to him then that almost every patient presented had a marked facial asymmetry, most noticeable in the relation on the horizontal plane of the two eyes to the vertical plane of the head. This observation was the basis of an investigation which has been conducted during the past five years. The present communication is a brief report of the results of a part of this investigation.

When one mentions the word "asymmetry" to the average psychiatrist, his reaction usually is that of skepticism. He says, "Is not everybody asymmetric? Is it not normal to be asymmetric? Is it conceivable that the two sides of the face should be absolutely symmetrical?" and so on.

In reply to this one must obviously agree. It is normal to be asymmetric, and nature is not so accurate a workman as to produce many individuals in whom perfect symmetry exists. When investigation is directed to the cranium as well as to the face, it appears that it is physiological to have an asymmetric skull.

As the word is used in this communication, however, it signifies a severe degree of asymmetry. Just where the dividing line should be between normal and abnormal asymmetry, is not known, any more than where the dividing line lies between normal mental function and abnormal mental function. In specific borderline cases, there would be difficulty in determining this, but in extreme cases, in which marked differences between the two sides of the face and cranium are observed, the fact that asymmetry exists is obvious to the eye.

In this investigation I have considered cases which have shown a difference in height of the two eyes of over 3 millimeters compared to a perpendicular drawn through the median plane of the skull. A number of measurements of the face were made which included the following points: A perpendicular line drawn from the root of the nose to the tip of the chin, a line from the tip of the chin to the outer canthus of each eye, with that of the other eye, and a line from the outer canthus of each eye to the root of the nose. These measurements were plotted, and the outer canthus of each eye was then fixed by a double measurement, which had to check exactly.

In difficult cases, or where there was the suspicion that the median line of the skull did not form a straight line, another measurement was taken from the outer canthus of each eye to the point of attachment of the nasal septum to the upper lip. In most of the cases so measured, it was found that the divergencies of 1 or 2 millimeters from the horizontal are instantly noted by the eye, so that having established this point, the exact measurement of this asymmetry was omitted, and it was decided to note as asymmetrical only those cases which instantly appeared to the eye as asymmetric, and to note as not asymmetric all cases that appeared not markedly asymmetric, so that the results here stated are to be considered as conservative estimates rather than extreme estimates.

It is, of course, desirable that some method be employed which will permit a permanent record to be made. The only practical method at present at hand is that of obtaining a reduced outline of the shape of the head by means of a "conformateur," such as is used by hatters in fitting men's hats. With this apparatus certain interesting outlines have been obtained. The accompanying illustrations show the appearance of the outlines so made. It will be noted that these tracings are made by connecting the points where the arms of the conformateur puncture the paper. The resulting outline is, of course, greatly reduced.

In practice, among hatters, this tracing is cut out of stiff paper and then inserted in a blocking apparatus which projects the variations to the natural size.

These outlines show distinctly certain asymmetries, and show a flattening and receding of the skull on the retarded side. They also show a noteworthy prominence in the parietal region, usually on the right side. It has been found that this corresponds to right-handedness, that in cases where a person is not right-handed, this prominence is absent. In those cases of so-called left-handedness examined, little difference was found between the two parietal regions with the conformateur. This may possibly indicate that the individuals examined were not truly left-handed, but were correctly speaking ambidextrous.

The attention of the author was called to this point by study-

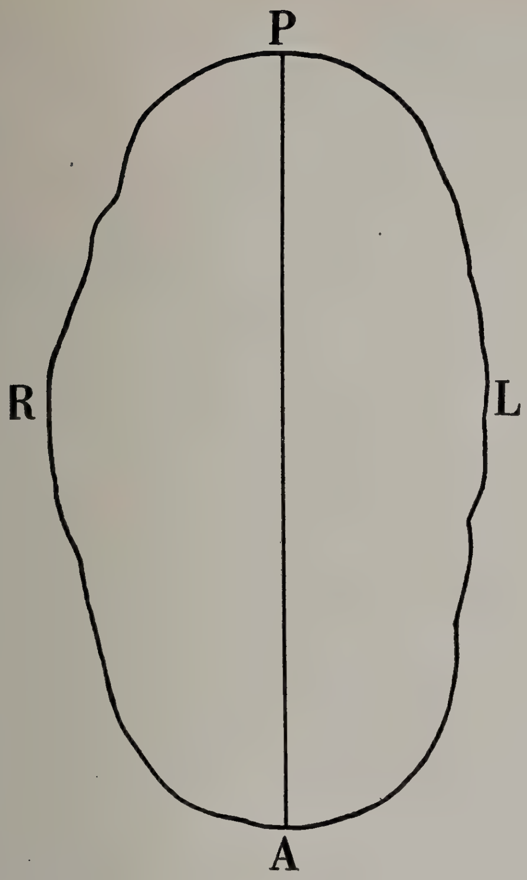


FIG. 1.

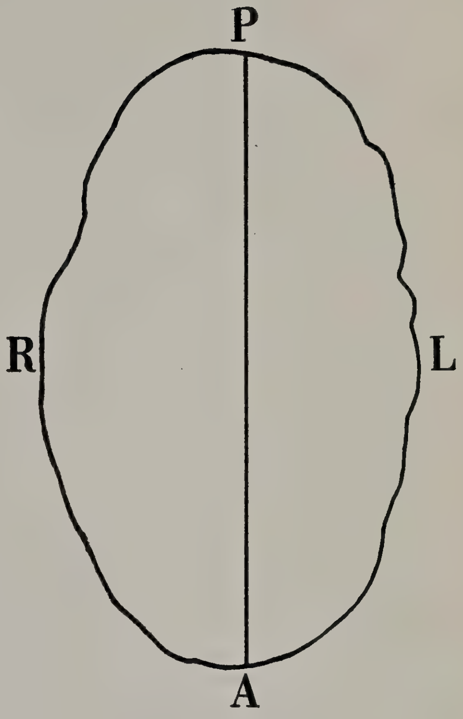


FIG. 2.

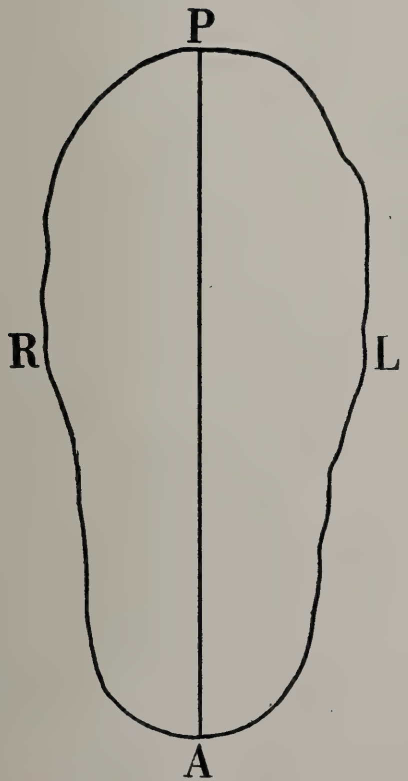


FIG. 3.

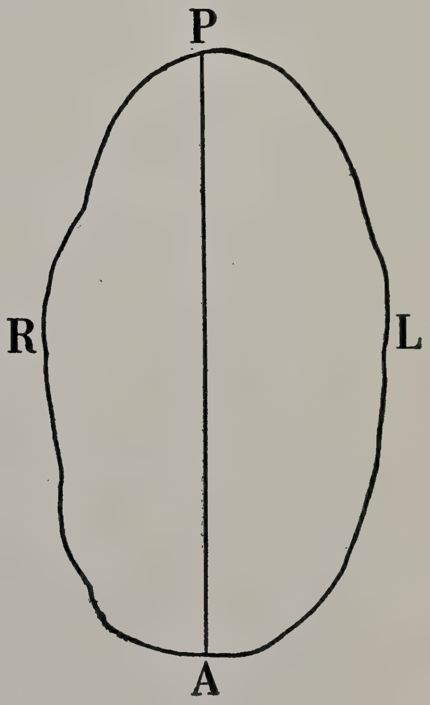


FIG. 4.

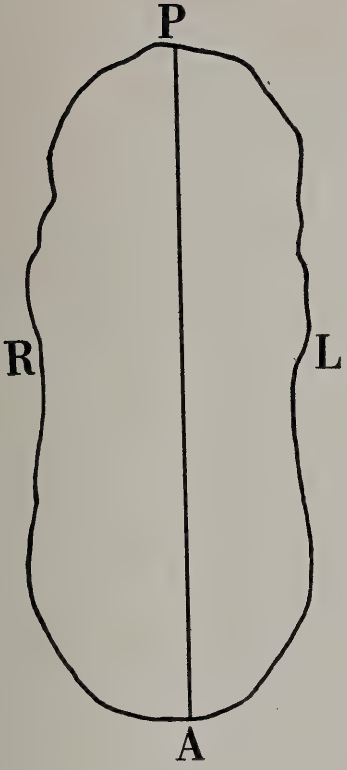


Fig. 5.

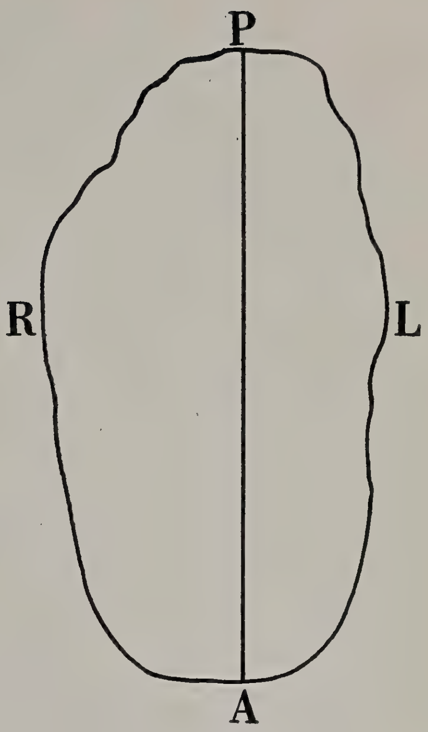


Fig. 6.

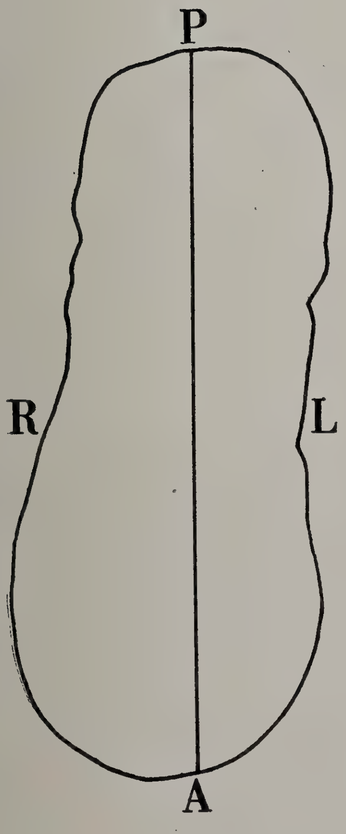


Fig. 7.

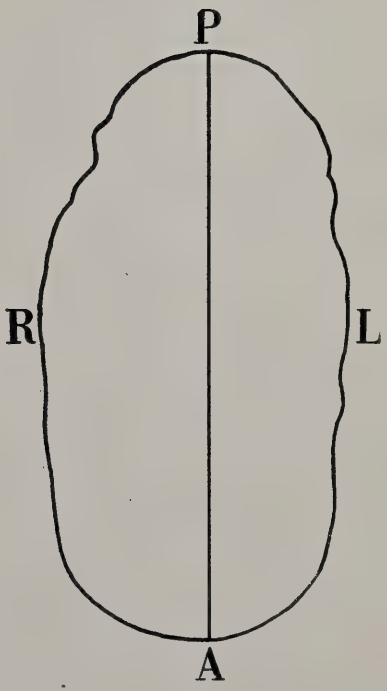


Fig. 8.

ing the tracings, and he has since made observations by inspection, and has been able to pick out the so-called left-handed people from a crowd by observing that the right parietal prominence was lacking.

The conformateur has certain defects which make the results obtained by its use not very accurate. In the first place, the construction of the apparatus is such that great accuracy cannot be expected from it. It is made of flimsy material and the points which perforate the paper move in loose tracks which allow considerable side play. There is also a certain amount of lost motion due to the fact that the spring which actuates the points is a long spiral, which is not always of uniform tension, so that an occasional point may not be applied closely to the head.

In the second place, it has this fundamental drawback in that the construction is such that the sticks of wood which fit against the head, and to which the marking points are attached are perpendiculars and therefore represent the widest diameters of the skull, it is true, but not necessarily points in the same plane.

Before any very accurate topographic work can therefore be done, it is necessary to correct these two errors in this mechanism. The writer is at present at work on an apparatus which it is hoped will overcome this difficulty.

It should here also be pointed out that the X-ray offers a means of investigating this subject, but on account of technical difficulties not very satisfactory results have been obtained to date.

A census was taken of all the patients and most of the employees at the Danvers State Hospital during one week, with the following results: —

A total number of 1,000 cases were observed. Of these, 281 were found to have no marked asymmetry, or 28 per cent; 719 were found with marked asymmetries. These asymmetries were divided as follows: 403 cases showed the left side of the face apparently larger than the right; 305 cases showed the reverse, namely, the right side of the face was apparently larger than the left.

Eighty-six employees were examined, and only 5 were found to be markedly asymmetric. Of these, 4 showed the left side of the face apparently larger than the right. The employees included mechanics, nurses and attendants. The 4 asymmetries were noted among the male attendants, 1 among the mechanics.

CRANIAL MEASUREMENTS.

Female Patients.

DIAGNOSIS.	No Asymmetry.	Left-sided Asymmetry.	Right-sided Asymmetry.	Atypical Asymmetry.
Toxic psychosis,	1	–	1	–
Alcoholism,	10	13	8	1
Alcoholic hallucinosis,	1	1	–	–
Korsakow's psychosis,	4	1	–	–
Involution psychosis,	–	1	2	–
Presenile,	3	3	1	–
Senile,	8	5	8	–
Arteriosclerosis,	10	–	2	–
Organic,	9	4	3	1
Epilepsy,	1	2	1	–
Dementia præcox,	39	173	117	2
Manic-depressive insanity,	16	21	15	2
General paresis,	4	3	2	–
Paranoia,	–	–	2	–
Hysteria,	1	–	–	–
Psychopathic personality,	2	–	–	–
Imbecile,	10	21	13	–
Unclassified,	22	78	53	1

Male Patients.

Alcoholism,	21	9	2	–
Morphinism,	2	–	–	–
Korsakow's psychosis,	–	1	2	–
Senile,	2	1	3	–
Arteriosclerosis,	3	3	3	–
Brain tumor,	–	1	–	–
Organic,	6	5	5	–
Epilepsy,	6	1	–	–
Huntington's chorea,	1	–	1	–
Dementia præcox,	43	31	31	–
Manic-depressive insanity,	19	7	7	1
General paresis,	8	6	9	–
Cerebrospinal syphilis,	1	–	2	–
Tabes,	1	–	–	–
Paranoia,	1	1	–	–
Neurasthenia,	1	–	–	–
Imbecile,	7	9	3	2
Unclassified,	18	2	9	1

The textbooks contain statements of which the following quotation from Church & Peterson's book on "Nervous and Mental Diseases," published in 1911, is an example: —

Inequality of the two sides of the face — when congenital and not due to some such disease as hemiatrophy — is to be looked upon as a stigma of degeneration.

In the same category may be grouped the various books which go on to point out the well-known stigmata of degeneration, such as deformities of the palate, the anomalies of the nose and eye and ear and so on. Kraepelin[1] points out that most of these stigmata of degeneration are to be used as evidence of psychopathic disposition with the greatest caution.

It is clear, however, that a change in conformation or a variance from the normal is of quite different value and significance in say the liver or brain. The brain is an organ which is preeminently characterized by the location and specific function of its individual cells. Since the brain is not a single organ, like the liver or the kidney, in which a cell at one point performs the identical function of every other cell, at any other point in the organ, but rather has the properties of a group of separate organs, some greater, some smaller in size, all of them consisting of cells with individual functions, even slight variations in volume of the functioning portion acquire a significance. Thus, in the liver, a change in the volume of the functioning cells means a greater or less capacity for the production of the specific secretions of the liver, but whatever the total quantity, a large number of cells could be destroyed without appreciably interfering with the work of the liver as a whole, and without becoming noticeable in any way. If the reserve force of the liver tended to be exhausted even, the other cells would merely increase their activity, and the total result would not be changed. In the brain this is quite different. One nerve cell cannot be substituted for another cell. If a nerve cell is thrown out of function, a definite loss of total function is the result. It follows from this that the size and complexity of the functioning portion of the brain, namely, the cortex, is of importance in estimating the potential ability of the brain. It does not, of course, in any way predicate the functional activity which is another matter.

While these principles are well recognized by anatomists, it has always been deemed unwise to lay too much stress upon outward indications of the size of the brain in the living. Rieger,[2] in 1885, showed that it was possible to estimate the contour of the brain fairly accurately by measurements upon the skull or upon the cranium of the living individual. Even if these measurements are comparatively accurate, they are only approximate, and too much reliance should not be placed upon them, since there is a well-known discrepancy between the external contour of the skull and the surface of the brain.

Virchow[3] has shown that the development of the skull follows closely the development of the brain, and that it originates in three embryonic centers of ossification, two of which are in the sphenoid bone, and one in the occiput, — all three arranged in a line running anterio-posteriorly through the center of the base of the cranium, and representing the bodies of the vertebræ from which these bones are developed. The skull and face develop from these centers as the petals of a flower develop from its center, and Virchow has shown how a very slight disturbance in the ossification centers will be magnified on the periphery so it will appear as a marked anomaly in the vault of the cranium, although the actual deviation is very small at the center.

Thoma[4] has shown recently that the structure of the bones is dependent not upon an underlying prearrangement whereby the bones are adapted to the strain that they will be subjected to, but rather that the structure of the bone depends upon the lines of force exerted upon them, and if these lines of force are changed, as by the transplantation of muscles, for instance, the structure of the bone changes in a corresponding fashion. So in the long bones, such as the femur, the lamellæ, which have long been pointed out as instances of good engineering principles, will become rearranged if the lines of force are applied in a different way, the bone being dissolved and laid down in new locations.

The same has been shown to be true in the skull. It is well known how a slowly growing tumor will either perforate the vault of the cranium or will cause a bulging of the bony walls. Cushing has shown how tumors of the pituitary gland will cause a cranial and facial asymmetry by their pressure on the sella turcica, which is located at the radial center of the skull.

All these investigations go to show that contrary to what has been held by some anthropologists and criminologists, the asymmetries of the cranial vault are probably not due to premature closures of sutures, but rather to an arrest in the development of the soft parts within — that the premature closure of the suture is probably secondary, therefore, and not primary.

The pictures represent an asymmetric skull from a patient who had an extreme facial and cranial asymmetry. In this case, it was the right eye which appeared higher than the left. It will be seen from the photograph that the right side of the head, contrary to external appearance, was not larger than the left, but smaller than the left, and that in this particular case this asymmetry extended through the entire right side of the cranium.

On account of the fact that the eye appears higher on that side of the cranium which is in reality smaller in volume, the face may appear larger on that side, and thus one may be misled into thinking that the affected side is the opposite one.

During development, the frontal region develops in a forward direction so that the chin becomes relatively less prominent, till finally the frontal region of the cranium dominates the face. The eyes and especially the superocular regions are thus pushed downward in relation to the chin by the development of the frontal region. If one side is arrested in development before the opposite side, the latter will push on and thus the eye on that side will be placed somewhat lower than the eye on the earlier arrested side. At present, the methods do not suffice adequately to demonstrate with any certainty the asymmetries in the temporal or the middle or posterior fossæ so that the remarks here made apply in the main to the frontal region.

The asymmetry thus explained means therefore not necessarily inadequacy of development but means inequality in development. If the individual is of only average intelligence and average ability it is likely that this arrested development signifies a certain degree of degeneracy in that we may assume that the larger hemisphere represents merely average intelligence. The one showing arrested development would, therefore, fall below the average. In cases of unusual intelligence, of genius, such asymmetries have frequently been noted, and it may be assumed that in these cases the lesser half was at least normally developed, and the opposite side is hypertrophied. Of course, at present, it is impossible to make definite correlations of this sort, and these statements have been made merely to point out the possible connection between such asymmetries and functional power.

One thing seems, however, to be probably true; namely, that asymmetry in any case indicates a tendency to psychopathy. According to this conception, therefore, the inequality of development of the brain probably indicates a weakness of one side as compared to the other. This weakness need not necessarily be effective all times, but merely latent and brought out under certain changed conditions.

A casual examination of groups of men met with in various places where a sufficient scrutiny could be applied, such as a student body in a university, the pupils of a large boys' school, and so on, as well as the photographs in the Rogues' Gallery of the Boston police, the portraits of noted criminals, and the patients that come before the examiners at the Psychopathic Hospital, leads the writer to the conviction that asymmetry indicates a variation from type either in the direction of defect or in the direction of genius.

It is not astonishing that marked asymmetry in criminals has attracted the attention of so keen an observer as Professor Roscoe Pound, Dean of the Harvard Law School, who informed the writer that his attention had been forcibly arrested by the very marked facial asymmetry which he observed in portraits of noted criminals, and in a number of criminals whom he had seen.

Marked asymmetry is a constant phenomena in insane hospitals and in the criminal courts. The writer has seen no cases of dementia præcox, with the exception of simplex or catatonic groups, who have not shown marked cranial asymmetry. The paranoid psychoses, in the experience of the writer, practically always are associated with a well-marked cranial asymmetry. On the other hand, in the schools and the universities where observations were made, asymmetries appear to occur, but are the exception, and are usually indicative of unusual ability or talent in some particular direction.

CONFORMATEUR TRACINGS.

Normal Individuals.

No. 1. — The head of an unusually intelligent and successful physician. Well rounded frontal region, symmetrical, showing the usual parietal prominence on the right side. Right-handed.

No. 2. — A Harvard professor. Very slight left-sided frontal defect. Slightly apparent right parietal prominence. Called left-handed, probably ambidextrous.

No. 3. — Young physician, successful. Slight left frontal defect. No marked difference in parietal region. No marked prominence on left parietal. Called left-handed, probably ambidextrous.

No. 4. — Normal, healthy individual. Professor of music. Very slight left frontal defect. Well-marked left parietal prominence. Left-handed, probably true left-handedness.

PLATE I.

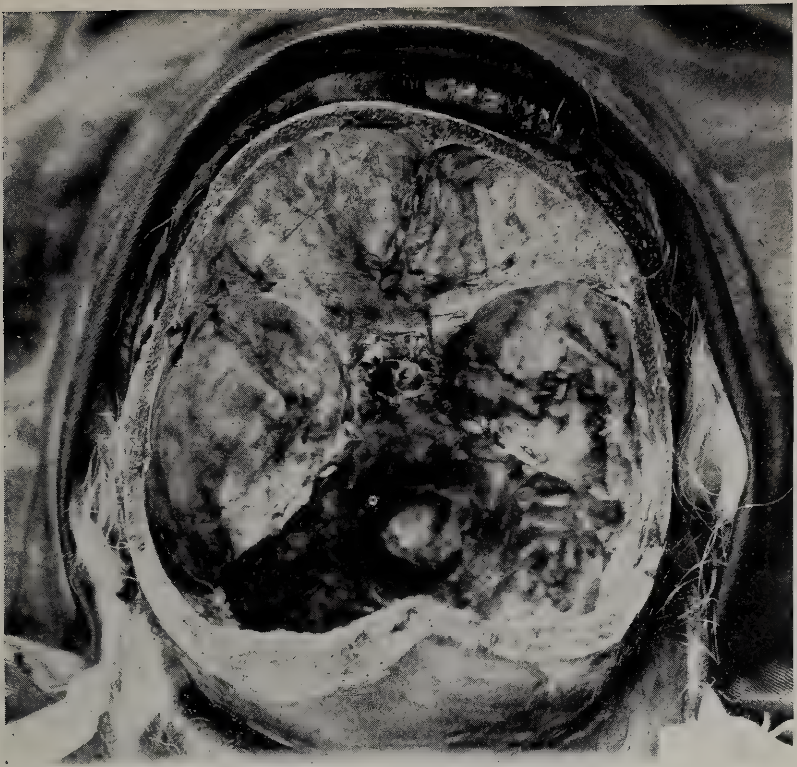


FIG. 1. — The floor of cranial cavity showing asymmetry. The frontal and temporal fossæ are shown distinctly. The frontal region on the right side is flatter than on the left. The right anterior fossa is clearly seen to be smaller than the left. The right middle or temporal fossa is likewise much smaller than the left. The posterior fossæ and the occipital region cannot be seen distinctly on account of curvature of the occipital lobe.

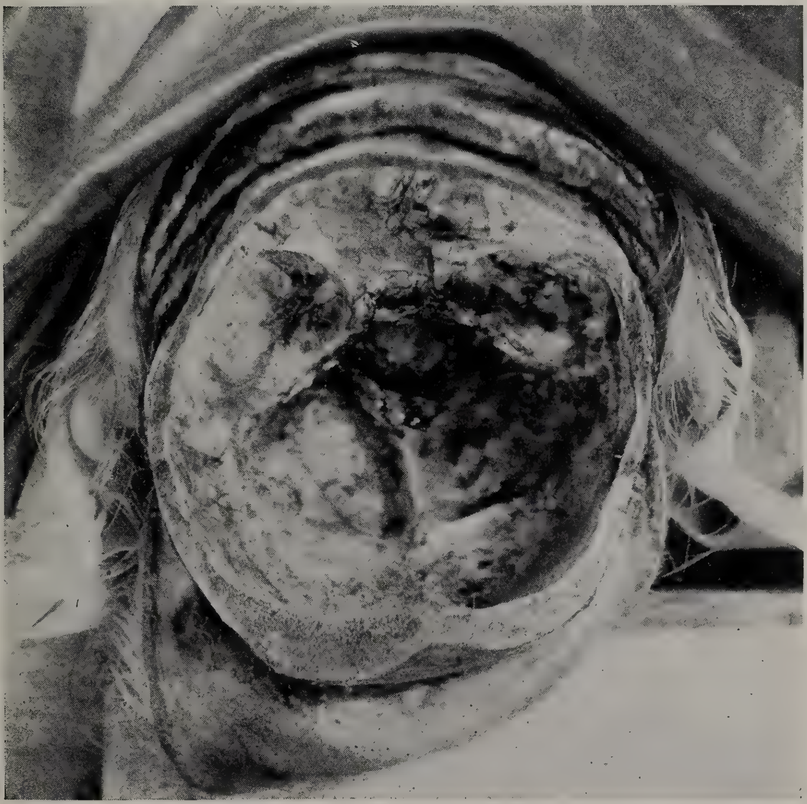


FIG. 2. — The same skull as Fig. 1, so placed that the posterior fossæ are in focus. The head has not been moved laterally. It will be seen that the right side here also is much smaller than the left.

PLATE II.

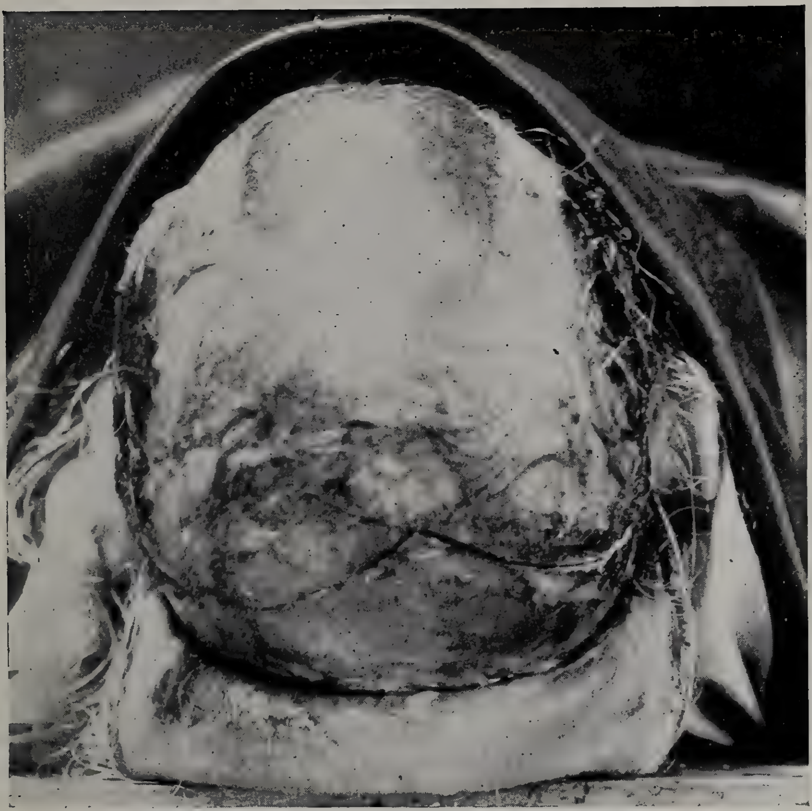


FIG. 3. — The same skull with the calvarium replaced, the scalp turned back. It is almost impossible, even on close scrutiny, to observe any great difference between the two sides, although by comparing it with Fig. 1 it will be seen that it exists.

This shows how difficult it is at times to determine from inspection of the vault of the cranium whether a marked asymmetry exists or not. In this instance the right side of the face seemed larger than the left.

Abnormal Individuals.

No. 5. — Marked left frontal defect. Slight right parietal prominence. Right-handed. Dementia præcox.

No. 6. — Marked left frontal defect. Marked parietal prominence. Marked occipital defect. Right-handed. Dementia præcox.

No. 7. — Marked left frontal defect. Marked left parietal prominence. Marked right occipital defect. Right-handed. Dementia præcox.

No. 8. — Marked left frontal defect. Marked right parietal prominence. Slight right occipital defect. Dementia præcox.

In all the conformateur tracings, a straight line has been drawn through the middle of the outline connecting the middle points in the anterior and posterior regions. In the asymmetric cases this line, to represent the median line of the skull, should probably be a curved line rather than a straight, but on account of absence of the accurate data it is impossible to construct such a curve. The incidence of this line, nevertheless, gives a very definite idea as to the degree of asymmetry if the abnormal cases are compared with the normal.

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QUESTIONS ABOUT THE DURATION AND CLASSIFICATION OF A BRAIN TUMOR.

By E. D. Bond, M.D.,

FIRST ASSISTANT PHYSICIAN, PENNSYLVANIA HOSPITAL FOR THE INSANE, PHILADELPHIA, PA.

A woman of forty-nine had a history of convulsions for twenty-nine years, headaches for two years, and many of the usual localizing symptoms of brain tumor for four months before her death.

Autopsy showed a tumor which might be classed as a glioma, but should be considered as coming from a precursor of the glia cell.

Clinical Record.

Mrs. E had her first convulsion when she was twenty, after the birth of her only child. Many convulsions occurred to the time of her death at forty-nine. These attacks are described by her husband as lasting from a few minutes to fourteen days; as often initiated by some startling event such as some one coming suddenly upon her when she was at work; as a stiffening of all the muscles of the body, "so that head and feet would almost touch behind;" as a violent shaking of the arms.

At thirty-eight an operation (curettage?) was done; the convulsions after this were not so frequent or so severe. At forty-seven came the menopause and severe headaches. At forty-eight in the spring headaches were more intense: they were better in the summer and grew worse again in September. She worried over financial difficulties. Physicians pronounced the case hysteria. On November first she took to her bed. In November and December, the two months before admission, the following symptoms appeared in the order given: incontinence of urine, vomiting, blindness of one eye, difficulty in speaking, inability to speak, incontinence of feces, paralysis of right arm and the leg. Even this condition was diagnosed as hysteria.

After admission she lived two and one-half months. Her condition throughout this time changed very little. All the symptoms spoken of above in the history were shown. In addition the right arm and leg were very tender to the touch for the first few days, after which they were anesthetic. The left arm showed cerea flexibilitas. The right knee jerk was absent; there was a Babinski sign on the right. The right pupil was larger than the left. The Wassermann on the blood was doubtful and cerebrospinal fluid was negative. The cells were not increased in the latter. The patient at times was able to answer questions. At one time she said that she was "disperik" and "charaterisic" and also said that her tongue was all gone and that she could never get it back.

Description of Tumor.

Complete autopsy showed little that was remarkable in the organs of the body. In the brain was found a tumor in the left parietal and occipital lobes, 6 centimeters in length, the other two dimensions being 3 centimeters at their greatest. The lesion extended to within 3.25 centimeters of the occipital tip. The shape was very irregular and the consistency variable. In one plane of section was an L-shaped mass, dark, hard, sharply defined to finger and eye, movable en masse in the very much softer surrounding tissue. The softer tumor tissue was pink; there was a thin light-yellow cloudy fluid in the central broken-down parts of the lesion. There was no capsule formation, and it was impossible sharply to distinguish the boundary of the new growth. The lesion extended from the roof of the ventricle upwards and to both sides in white matter, never directly invading the cortex (Fig. 1).

The microscope showed a tumor composed of large cells, with little fibril formation, supported by considerable connective tissue.

The tumor cells were large with much cytoplasm, round, triangular or cylindrical; the nucleus always eccentric. Mitoses, large multinucleated cells, inclusions, and vacuoles were frequent. There were many fields where cells were piled layers deep and apparently independent of stroma, but usually the connective tissue framework was abundant and strong and the cells presented a striking alveolar arrangement (Fig. 2). Many of the cells in the gland formation had a deep staining free margin, which suggested end plates or cilia.

On approaching the tumor from normal surrounding tissue first a zone of numerous blood vessels was noticed, then groups of apparently isolated tumor cells. Sound tissue was often prolonged into spaces between the gland-like formations.

Detritus and tumor cells were found in the ventricular cavity near the lesion. No sign of proliferation of the ependymal cells *in situ* was noticed.

DURATION.

A tumor with the above microscopical characteristics would be considered to have been rapid in its growth. One hardly feels justified at dating back twenty-nine years to the first convulsion. In reading clinical reports of brain tumor, however, one constantly sees the statement, "this man, aged thirty, had epileptic attacks from the age of twenty, or headaches from the age of twenty-five," later followed by the assumption that "the tumor had existed for ten years or five years." It is a dangerous habit to place without due consideration the onset of a "first symptom" when that symptom is one belonging also to other diseases.

Cushing remarks that brain tumors are of longer duration than is generally supposed. He gives a case[1] resembling the present one: a woman who for twenty years had suffered from irregular headaches, periods of amenorrhea, intermittent grades of hemianesthesia, and hemianopsia, inversion of color fields, and periods of semi-consciousness. During all this time hysteria was the only diagnosis. A terminal choked disc betrayed the lesion — a benign tumor of the right temporal and uncinate region.

In the case presented in this paper it is more reasonable and more useful to consider the convulsions as symptomatic of the tumor or a lesion on the site of the tumor.

CLASSIFICATION.

Closely packed cells with abundant cytoplasm, producing few or no fibrils, arranged in glandlike formation, do not at first thought suggest glioma. But this is a primary brain tumor. It is recognized that even lack of glia fibrils does not necessarily rule out glioma, while an alveolar arrangement is possible though rare. Ribbert[2] shows rosettes in a glioma, and describes epithelial-like formations in a glioma of the cerebellum. Mallory[3] shows a somewhat similar picture of neuroglia abutting on stroma — remarkable because it is the fibrils and not the cell bodies which produce the effect.

"Gland and cyst-like cavities lined with ependymal cells . . . suggest that these particular tumors at least arose from some abnormality of the central canal, such as displacement of a group of ependymal cells in the early embryonic life," says Mallory.[3] In this particular tumor the single-celled linings about a lumen suggest ependyma; the tumor touches the roof of the ventricles.

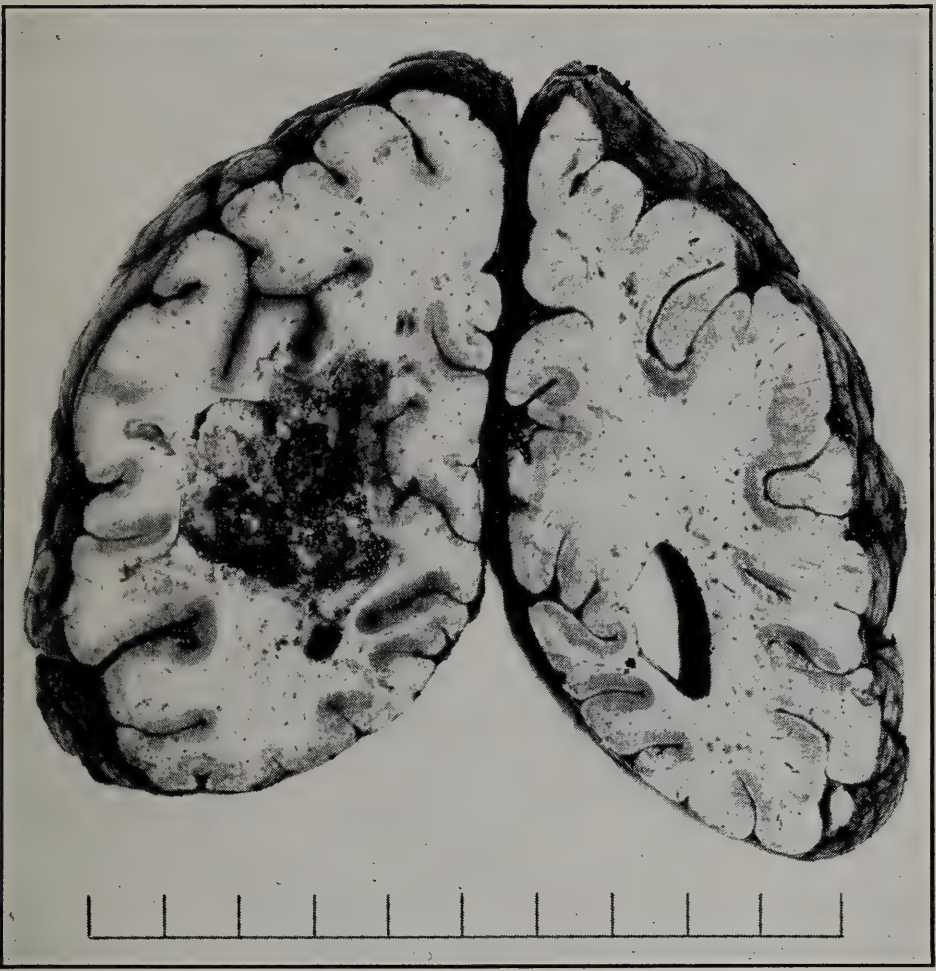

FIG. 1. — Coronal section to show area invaded by tumor.

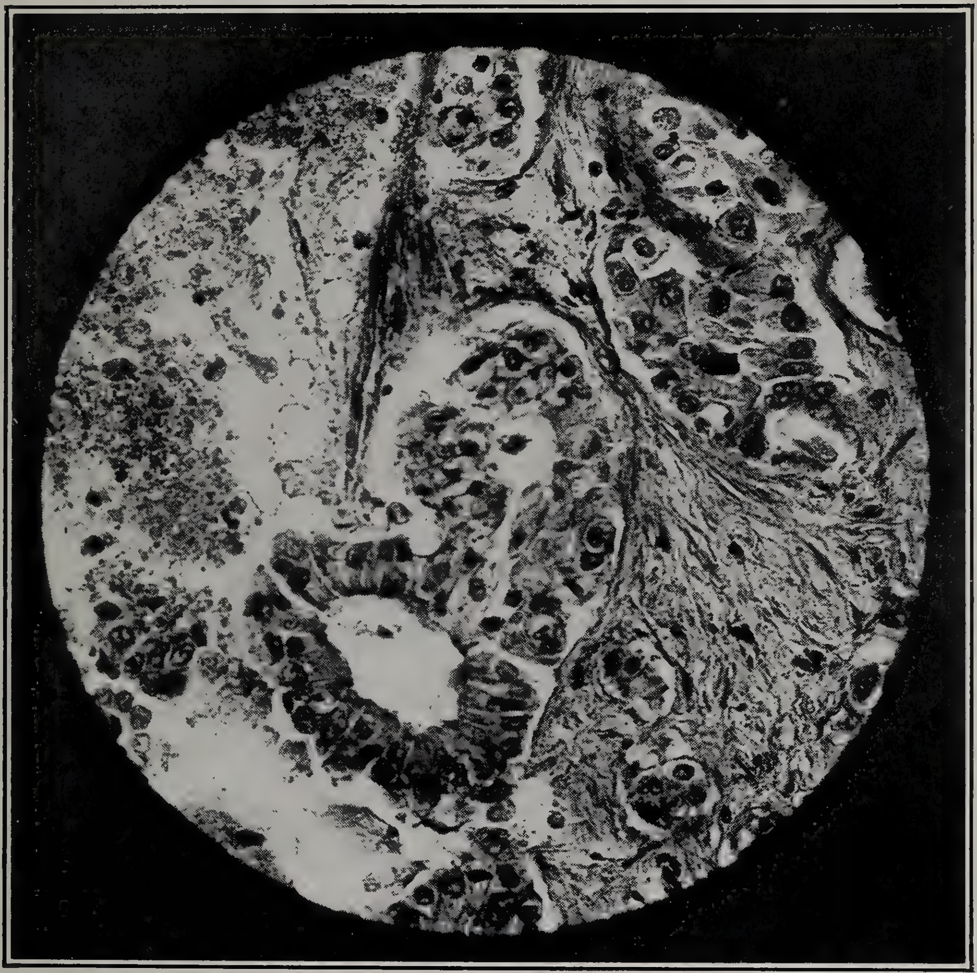

FIG. 2. — Typical area of tumor.

It seems that cells which display characteristics on one side possessed by glia and on the other by ependyma should be referred to the common ancestor of glia and ependyma — the undifferentiated cell lining the central canal in the embryo.

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MICROLIENIA AND OTHER OBSERVATIONS ON THE SPLEEN IN PSYCHOTIC SUBJECTS.

By M. M. Canavan, M.D., and E. E. Southard, M.D.

The curious observation of a spleen weighing but 7 grams in an autopsy performed in 1909, — Danvers State Hospital autopsy series No. 1388, — has suggested an inquiry into microlienia and other spleen lesions in psychotic cases. The Danvers laboratory has for years been interested in the relation of visceral non-nervous lesions to mental disease and has carried on a number of studies upon these viscera alongside studies of the brain. Whereas studies of the brain and especially of the cerebral cortex may be supposed to throw a great deal of light upon certain psychoses (such as paretic neurosyphilis and sundry organic dementias), it may prove perhaps quite important to study other viscera than the brain if we are ever to learn the origin of certain other diseases, for example, manic-depressive psychosis or even dementia præcox.

In the literature of medicine of late there has been a great deal of work upon the endocrine glands, although the anatomy and histology of these glands have not been drawn upon to any extent in a concerted attempt to learn what can be found in these glands in the psychoses. Anna Peabody contributed from the Danvers laboratory a paper on Changes in the Thyroid Gland in Cases of Mental Disease, finding that over half the cases had chronic changes of a fibrous nature. A similar study of the pituitary body was made by Dr. Thornton Stearns which, although still unpublished, gave somewhat the same general results and even gave indications that the pituitary body is still more subject to chronic changes in the psychoses than is the thyroid gland.

A partial and still incomplete study of the adrenal gland was undertaken by Anna Peabody, and the number of changes in the adrenals was also found to be large, as indicated by its histology. In short, wherever one looks in remote parts of the body, one is apt to find in the psychoses a high percentage of chronic changes. Whether these chronic changes have anything to do with the psychoses, in particular as to their origin, is another question. However, when the psychoses occasion living conditions or somatic changes that indirectly bring about such lesions as chronic thyroiditis, chronic hypophysitis, adrenal changes, etc., then it is proper to ask whether these chronic changes do not themselves react upon the psychoses. For example, what is the effect of phthisis pulmonalis upon psychoses? Some statistical considerations have been published from Massachusetts autopsy data and the hypothesis was raised that the phthisis might indeed be able to affect the symptom pictures of certain psychoses. Accordingly, the relation of somatic disease to psychoses, that is, somatic disease which does not affect the nervous system, has been proved to be a considerably closer relation than was for many years suspected. Add to this that modern work is giving more and more attention to the somatopsychoses, often called "symptomatic" psychoses. If we can regard as proved that certain psychoses are directly due to toxines or chemical substances derived from diseases like typhoid fever, pneumonia, heart disease, kidney disease, then it is plain that a review of the findings in the viscera in all sorts of psychoses should be made.

One such review of findings in the kidney has been made from Massachusetts material, being an elaborate study of the macroscopic and microscopic lesions in 100 non-selected cases. An extraordinarily high percentage of chronic lesions was found in the kidneys in these 100 cases. In fact, normal kidneys must be of the greatest rarity in psychotic cases at autopsy. No instance of absolutely normal kidneys was found in the series. Thirty-three cases showed a chronic interstitial nephritis, which was very well marked in the gross as well as microscopically. Albuminuria had been found in 38 per cent. of those 65 cases in which records were available; in 28 per cent. cylindruria occurred. On the whole, taking into account both gross and microscopic lesions of severity, and excluding cases with acute lesions of the kidney, there were found 55 instances of chronic lesions.

It can be supposed that the liver would also show a similar high percentage of chronic lesions, and it may prove eventually important to study the liver on account of its utility as an index of dietary. As a matter of fact, the question of dietetics might well be studied in autopsies upon psychotic cases interned in institutions. Gastrointestinal disease is extraordinarily frequent and of various types amongst these cases. Atrophy of the mucous membrane is a frequent finding. Gastric dilatation and atrophy of the stomach wall are by no means uncommon.

There may indeed be back of this disorder of the mucous membrane a striking deficiency in the lymphatic apparatus. An index to this lymphatic deficiency may very well be afforded by the size of the spleen.

In short the curious observation above mentioned of a spleen weighing 7 grams is one of considerable interest, if it should prove to be an indicator of microlienia in the psychoses. Orth is quoted as placing the weight of the spleen as a variable one between 150 and 250 grams. The average is sometimes set as 171 grams. A large majority of spleens of our non-selected cases of mental disease weighed less than 125 grams, and a long series of such spleens will fail to show any spleen weighing as much as 171 grams.

Any one who has busied himself with much autopsy work on institutional psychotic cases has a pretty definite notion that the lesions found therein present no such general picture as those of non-psychotic subjects, such as are found in the autopsy room of a general hospital clinic. Of course the institutional psychotic cases are on the average older when they come to autopsy. Aside from this greater age, there is hardly a more arresting feature in the autopsy pictures presented in psychotic cases than the slight reaction to infection which many of them show. Of course infection is common enough amongst psychotic subjects, in fact, may be regarded as almost universal, but no marked reaction to infection in the shape of any pronounced and elaborate inflammatory process is ordinarily found. Charcot pointed out many years ago that such reactions to infection were rare in the Salpêtrière material. He pointed out, too, it will be remembered, how slight a reaction there is in Salpêtrière material to serious disease, such as gall stones and cancer. Every one knows, also, how frequent middle ear infections are in psychotic cases that go clinically unnoticed for months or years. The spleen would offer a good opportunity for the study of this reaction or lack of reaction on the part of psychotic patients to infection.

Looking over a series of over 100 non-selected cases, no sort of relation was found between enlargement of the mesenteric lymph nodes and enlargement of the spleen. The mesenteric lymph nodes were found enlarged in great numbers of cases when the spleen remained quite without reaction. Of course not enough systematic work with the peripheral blood in psychotic cases has been done yet to warrant particularly intensive studies of the blood, bone marrow, lymph nodes and spleen. Some higher kind of correlation between clinical and autopsy studies in hospitals for the insane will have to be brought about before we can hope for the best work.

Accordingly, this study has to be of a pioneer nature and we cannot hope for immediate or final results. In the matter of the comparative reaction of lymph nodes and spleen in some studies from the Danvers and Boston laboratories on the bacteriology of lymph nodes, it was found that many cases had exceedingly small amounts of lymphatic tissue. At all events, careful search for enough tissue from which to take a bacterial culture would often prove unavailing. It would seem as if many psychotic cases had a sort of hypolymphatic status. If we couple this situation with the above-mentioned thinness of the intestinal wall found in so many cases, we might conceive a certain tendency to general hypolymphatism in mental disease, or in a majority of mental cases coming to autopsy. It would be desirable to develop some more precise technique for measuring amounts of lymphatic tissue in the nodes and in the intestinal wall. Small size, aplasia and atrophy are decidedly less easy to diagnosticate than large size, hyperplasia and hypertrophy.

It is natural in this situation to turn to the spleen as an organ readily accessible to weighing and as an organ whose weight may indicate the amount of lymphatic tissue in the body.

Of course the spleen is composed of tissue not exactly comparable to the tissue of lymph nodes, indeed but a small amount of splenic or malpighian nodules are at all exactly comparable to lymph node tissue. The bulk of the spleen is composed of splenic pulp, which is, according to the histologists, more comparable with the blood sinuses of hemolymph nodes than with any other lymph node structures. Of course, too, we must concede that even aside from various splenic diseases, the spleen is tremendously affected by different degrees of blood filling, by leucocytosis, by lymphocytosis and by the stromata of red blood corpuscles, and even by the effects of lipemia.

The spleen that weighed but 7 grams occurred in a female subject, forty years of age, the victim of dementia præcox. This patient had suffered for two years from a persistent ulcerative colitis, non-tuberculous in nature. There were apparently no hemolymph nodes in the body. The subject had, however, enlarged retroperitoneal, mesenteric and pelvic lymph nodes.

Litten speaks of a 30-gram spleen in a psychopathic subject, apparently regarding the phenomenon as one of malformation. The finding of spleens weighing but 30 grams, however, is not at all uncommon. There have been found no less than 19 spleens weighing 30 grams or less in about 1,000 autopsies made at the Danvers State Hospital. It is entirely unlikely that these subjects are to be regarded as malformations in the sense of Litten, who must have drawn his conclusions from a limited experience.

The average age of 100 cases subject to special examination in this study proved to be a little over fifty-eight years. There were two spleens weighing 510 and 555 grams respectively. Excluding these very unusual cases of relative splenomegaly, we found the average weight of the spleen in the 98 remaining cases to be 142 grams, — below the minimum given by Orth, namely, 150 grams, and decidedly below the average.

S. R. Christopher has spoken of what he calls the "spleen rate," namely, the percentage of persons with enlarged spleens in a given community. If this definition be taken, the percentage of enlarged spleens in psychotic cases is certainly low.

The spleen is thought by some to be large in well-fed persons and small in starved persons. Which way the relation runs and whether the spleen size has anything to do with the digestive powers of the subject may be questioned. The spleens histologically examined in this study occurred in approximately the same cases as the kidneys studied in the series above mentioned. The histology of the spleen in 100 cases was systematically examined. Notes were taken as to the condition on the tunica cerosa, in the tunica albuginea, in the trabeculæ, in the pulp cords, and in the arterial twigs and veins, as well as in the malpighian bodies in which the rows of cells were counted.

As for plasma cells in spleens of general paretics, they were not constantly found therein (18 paretics in the whole series). There was just as much plasmocytosis in other psychoses as in general paresis. The lurking-place of spirochetes in the soma of general paresis is still in question; the 18 spleens were carefully studied and no spirochetes were found.

Perhaps the most interesting point in the histology of the spleen as here studied is the great number of cases, 67 per cent., in which plasma cells were found in the pulp cords. This is the more interesting inasmuch as some authors count plasma cells as pathological when found in the pulp. Mallory, for example, counts as normal only lymphocytes, endothelial cells and fibroblasts as normal in the pulp, counting plasma cells, eosinophilic myelocytes and neutrophilic myelocytes as pathological. Mallory gives an order of increase of sundry cells under pathological conditions and places plasma cells fourth in his list, which includes polynuclear leucocytes, endothelial leucocytes, lymphocytes, plasma cells, eosinophiles and myelocytes. From the results of this study it might be inquired whether plasma cells are normal in the spleen, or whether we are to regard the spleens of psychotic subjects as very frequently abnormal.

The study of the kidney above mentioned also took into account the plasma cells, and they were found in 42 per cent. of the series distributed, as a rule, about the glomeruli. It was suggested in this study of the kidneys that the periglomeruliar distribution of the plasma cells might also suggest special toxic conditions there. In fact there was very frequently a glomerular lesion associated with these plasma cells in the kidney. There were just as many instances of plasmocytosis in persons under fifty years of age as of persons over fifty years of age in the kidney series. Especial attention was paid to the occurrence of plasma cells in the kidneys of general paretics on account of the constant occurrence of these cells in the brains of general paretics. Seventeen of thirty paretics in the kidney series showed plasma cells in the kidney.

SUMMARY.

1. Microlienia is frequent in the bodies of psychotic subjects.

2. Possibly this small spleen is an index of general hypolymphatism in the body. At all events, it is correlated with these mucous membranes and with a small amount of lymph node tissue in a large number of instances. The "psychotic" spleen-liver index was 112 to 1,362, as against normal, 171 to 1,500.

3. Chronic lesions are frequent, for example, 15 per cent. of lesions in the capsule; 28 per cent. of lesions in the tunica albuginea; 12 per cent. of thickenings in the trabeculæ; 67 per cent. of plasma cells in the pulp cords; and 86 per cent. of thickenings in the arterial twigs.

4. The high degree, 67 per cent., of plasma cells in the pulp cords seems of importance when it is considered that some authors feel that plasma cells in the spleen have pathological significance.

5. A similar study of kidney lesions in the same series, published in 1914, showed but 42 per cent. of plasma cells in the kidney.

6. As for the malpighian bodies, considerable variations in the number of rows of cells was found therein, 3 to 30.

7. Whether this hypolienia has anything to do with reactions of psychotic subjects to infection must remain doubtful.

8. It would appear that further studies of the hemopoietic system ought to be made in the psychoses and ought to be supported by accurate clinical studies of the peripheral blood *intra vitam.*

9. Eighteen spleens of general paretics were carefully studied for spirochetosis; no spirochetes were found.

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ON THE CHARACTERISTICS OF THE SPINAL FLUID FOUND IN NINE CASES OF CORD COMPRESSION.

By James B. Ayer, M.D., Boston.

The writer's attention was only a short time ago called in an insistent manner to the occurrence of certain characteristics exhibited in the spinal fluid in cases of cord compression; on two consecutive days he had the opportunity of seeing — once at autopsy and once at operation — definite mechanical cause for the symptoms of transverse myelitis and for the accompanying venous stasis, which, in the author's opinion, is the chief factor in the production of serous spinal fluid as found below the site of obstruction.

American literature yields little on this subject, but several French and German authors have collected cases illustrative of this condition. Perhaps the two best articles are by Mestrezat and Raven. The former, writing in 1912[1] in his important work on the spinal fluid, devotes thirty pages to discussion of what he terms the "Syndrome de coagulation massive et de xanthochromie." He gathered 21 cases from the literature of transverse myelitis, in which the spinal fluid was yellow in color, showing great excess of proteids, presence of fibrinogen, and few or no cells. Most of the cases were tumor of the cord. He considers as necessary for the production of this fluid the presence of a closed cavity by pressure on the spinal cord, and venous stasis, causing petechial hemorrhages or transudation, the latter probably most important. Mestrezat also recognizes a mild degree of this same condition, the fluid colorless and with the other characteristics less pronounced, also indicative of spinal cord compression, this type of fluid frequently to be found in Pott's disease.

Raven[2] writing later, in two articles collects 71 cases which exhibit the "compression syndrome," 22 being his own. He includes in his series both types of fluid as described by Mestrezat, and concludes that marked excess of albumin alone, without cell increase, with or without xanthochromia and fibrin formation signifies spinal cord compression. His cases vary in location, — cervical, dorsal, lumbar and sacral, — and in position of the compressing agent, — extradural, intradural and intramedullary; pressure from all gave similar spinal fluids. Nor were there found to be changes in the spinal fluid characteristic of different pathological processes.

The author here presents 9 personally observed cases in which the spinal fluid shows the characteristics of compression in the broad sense. All contain great excess of coagulable proteids without marked cellular increase, and 4 of them xanthochromia. These fluids stand out from a series of several hundred punctures because of their excessive proteid content, this characteristic not being approached in any others except in the case of acute meningitis and rarely very active general paresis, both of which conditions show other changes which readily distinguish them. All occur in cases presenting symptoms of more or less complete transverse myelitis, and in all a mechanical factor is demonstrable. The appended table presents the facts in concise form: —

Cases.	Symptoms and Signs.	Spinal Fluid.	Result.
I. Pressure on cord from extradural abscess.	Complete transverse myelitis, middorsal; one week.	Yellow, clear with fibrin clot (spontaneous); coagulable proteids greatly increased; cells, 0; pressure, "normal;" culture, negative; Gold Sol, "meningitis."	Autopsy: pressure on fourth and fifth dorsal segments by pus, extradural.
II. Progressive paralysis from extradural endothelioma.	January, 1914, Brown-Sequard syndrome; eight weeks' duration. Probable diagnosis: "syringomyelia."	Colorless; proteids much increased; cells, 8; Wassermann, negative.	
	December, 1914, increase of symptoms, approaching tranverse myelitis. X-ray of spine negative.	Colorless; proteids much increased; cells, 1; Wassermann, negative; pressure, 150 mm.; Gold Sol, "syphilis."	
	August, 1915, partial transverse myelitis at fourth dorsal segment; unable to walk.	Blood-tinged; proteids much increased; cells, 26; Wassermann, negative; Gold Sol, "tuberculosis or tumor."	Aug. 1, 1915, operation: endothelioma size of English walnut pressing on sixth dorsal segment; erosion of lateral wall of vertebral canal into base of fourth dorsal segment of spine; removal with complete recovery of patient.
III. Pressure from Pott's disease.	July, 1914, partial transverse myelitis; four weeks. X-ray shows distinct difference in articulations of lower cervical vertebræ.	Colorless; proteids much increased; cells, 26; Wassermann, negative; Gold Sol, "tuberculosis or tumor."	Operation: cord normal; bulging of anterior wall of spinal canal caused by extradural tubercular abscess; result, improved.
IV. Fibroma of cauda equina.	September, 1915, pain and paralysis of legs, without loss of sphincters or sensory disturbance characteristic of transverse myelitis; slowly progressive.	Colorless; proteids much increased; cells, 40; Wassermann, negative; Gold Sol, "tuberculosis or tumor;" pressure, 110 mm.	First operation: no tumor found (too low). Second operation: fibroma found upon one of caudæ equinæ, molded to the shape of the spinal canal.
V. Intramedullary tumor.	Illness began seven years ago with pain in left arm, which was replaced four years ago by numbness; later, stiffness of legs. X-ray: distinct atrophy of seventh cervical vertebra.	Yellow; proteids much increased; cells, 6; Wassermann, negative; Gold Sol, "tuberculosis or tumor;" pressure, "normal."	Operation: swollen, discolored cord, at seventh cervical segment level. Diagnosis, "intramedullary tumor." Partial benefit.
VI. Glioma of brain; extension to spinal meninges.	Marked ataxia of legs of few weeks' duration, rapidly progressing to motor and sensory paralysis with upper level at eighth dorsal segment; optic neuritis, developing into choked disc, and symptoms of increased intracranial pressure. X-rays of spine and cranium, negative.	Yellow, no clot on standing; proteids much increased; cells, 11; Wassermann, negative; Gold Sol, "tumor;" pressure, 170 mm.	Operation: subtemporal decompression; no tumor found. Autopsy: glioma at base of brain, and also extending up and down cord for greater part of its length between membranes.

CASES.	Symptoms and Signs.	Spinal Fluid.	Result.
VII. No compressing agent found.	For thirteen years increasing paræsthesia of fingers, and later feet; recently cutaneous sensory disturbance to level of upper dorsal. X-ray, negative.	Colorless; proteids moderately increased; cells, 0.	Operation: discolored cord at fourth dorsal segment; cord not enlarged.
VIII. Charcot spine.	1913, typical low tabes of two years' duration; treated with salvarsan and mercury, without change.	Colorless; proteids slightly increased; cells, 78; Wassermann, negative (later positive) (Wassermann, blood positive).	
	1915, cutaneous, sensory disturbance with Babinski; knuckle on lumbar spine. X-ray: fusiform swelling about and involving high lumbar vertebræ.	Colorless; proteids greatly increased; cells, 21; Wassermann, positive; Gold Sol, "syphilis."	Plaster cast gave partial relief.
IX. Chronic, progressive, syphilitic lepto-meningitis.	1908, treated for syphilis of nose.	– – –	
	May, 1915, left sixth nerve palsy, six months' duration, with pains in legs and unsteadiness; Argyll-Robertson pupils, but normal reflexes; improved under salvarsan.	Colorless; cells, 10; Wassermann, negative; proteids not examined.	
	March, 1914, better.	Colorless; cells, 44; Wassermann, positive; proteids not examined.	
	August, 1914, complains of pain about shoulders, and stiffness in walking.	Yellow; proteids much increased; cell, 1; Wassermann, anticomplementary; pressure, 110.	
	Nov. 7, 1914, no change in condition.	Clear, yellow; proteids greatly increased; cells, 23; Gold Sol (?); pressure, 180.	
	December, 1914, marked ataxic-paraplegic gait, with Babinski and clonus, on both sides; atrophy of shoulder girdles; subjective numbness.	– – –	
	July, 1915.	Colorless; cells, 5; proteids moderately increased; Gold Sol, "weakly positive for syphilis."	Oct. 8, 1915, operation: showed extensive fibrous lepto-meningitis, encasing cord on posterior surface.

DISCUSSION.

Out of a large series of examinations of the spinal fluid the findings in 9 cases, all personally known to the writer, stand out as distinctive. Characteristic of these fluids is a high protein content without marked cellular increase, with in 4 cases xanthochromia. In every case there were symptoms of partial or complete cord compression, and in 8 of the 9 a definite compressing agent was found by X-ray, operation or at autopsy. Even in this small series of 9 cases we find the site of pressure to be in cervical, dorsal and lumbar regions of the cord and cauda equina. As the longitudinal situation is diverse, so also is the lateral position of the compressing agent, in 1 case pressure being from within the cord, in 2 cases from meningeal causes, in 4 from extradural agents, and in 1 from a growth in the cauda equina. Moreover, the pathological process causing the pressure is varied as also the aspect of the cord compression; this is best seen by glancing at the following table: —

CASE I. — Pyogenic abscess by extension, pressing upon dura dorsally.

CASE II. — Endothelioma, pressing upon dura dorsally.

CASE III. — Tubercular abscess pressing upon cord ventrally.

CASE IV. — Fibroma of one of caudæ equinæ, in its growth assuming a sausage-like shape corresponding to the size of the vertebral canal.

CASE V. — Intramedullary swelling, pathology unknown.

CASE VI. — Glioma, extending along meninges, encasing the spinal cord.

CASE VII. — No compressing agent found.

CASE VIII. — Charcot spine; X-ray showing disintegration of vertebræ and a lateral shadow.

CASE IX. — Syphilitic, chronic, progressive leptomeningitis.

Some authors make a sharp distinction between fluids possessing a yellow color and spontaneous clotting and those which simply show excess of proteids. Such differentiation is not apparent in this series of cases; all seem to indicate the same thing, namely, cord compression; and the one outstanding characteristic is excess of proteid without evidence of exudation sufficient to account for the same. It may be that the syndrome of massive coagulation with xanthochromia has some special significance, though our cases do not show this to be the case, unless it speaks for rapidity of the compressing process or the completeness of the same.

It is the author's belief that the syndrome here dealt with is an important adjuvant to the diagnosis of cord compression. It is certain that the spinal fluid changes frequently precede the symptoms and signs which clearly indicate cord compression, and that the tests are of sufficient reliability to cause a resort to laminectomy before great destruction of nervous tissue has been produced.

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SOME OBSERVATIONS ON THE INFLUENCE OF ANGLE OF SECTION ON MEASUREMENTS OF CORTEX DEPTH AND ON THE CYTO-ARCHITECTONIC PICTURE.

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The observations here recorded were planned as a preliminary to a more ambitious group of studies of cell size, development, spacing and lamination in certain areas of the cortex in the normal and in the defective and demented classes.

A thorough estimate of the structural integrity or stage of development of the cortex should take cognizance of the number, size and development of the nerve cells, the number and size of afferent and efferent myelinated fibers, the richness of the dendritic ramifications of the cells, the wealth of terminal arborizations of afferent fibers, propriocortical axons and recurrent collaterals, the neuroglia cells and fibers and the glial framework which forms the support of the non-medullated fibers in the cortex and finally the vascular apparatus with its accompanying mesodermal tissues. It is obvious that such a review is scarcely possible with our present technical methods except over relatively small areas of the brain. Attempts have been made to evaluate the cortex on the basis of intricacy of its sulcation, its depth and its cell content.

Hammarberg studied the number, size and development of the cells in nine cases of idiocy and imbecility. His cases were all of a rather pronounced type of clinical defect and his estimates of cell numbers were based on counts in carefully measured cubes of cortex with sides of 0.1 millimeter and do not bring out clearly the relationship of cell numbers to the amount of the intercellular space in which lie structures of importance equal to that of the cells.

In the course of a somewhat intensive study of the cytoarchitectonic map of an hydrocephalic imbecile at the laboratory of the Danvers State Hospital in 1907, the writer encountered many areas where the attenuation of the cortex was marked but in which the cells had apparently been relatively well preserved, yielding a picture of great cell richness in an extremely thin cortex which would obviously have given an abnormally high count if the number in a given cubic volume had been used as a basis, while it is equally obvious that measurements of the cortex depth would have failed to express the situation clearly. It seems probable that the attenuation here was in part at least due to lack of development (or possibly destruction) of the intercellular structures. Some of the loss may perhaps be attributed to the loss in diameter of the myelin sheaths, a suggestion supported by the greater relative loss in white matter. Another factor which may have played a part is that of the size reached by the nerve cells. Donaldson has shown that there exists a difference both relative and absolute in the weights of the central nervous system of the gray and white rat and that this is correlative to a difference in size of the individual cell and fiber elements and not to their number or apparent stage of development. This points to the tentative conclusion that a small brain whose size is dependent not on a reduction in number of essential structures but rather on the size of the constituent elements may yet from the functional standpoint be relatively normal, and offers a possible explanation for the cases of average or even more than average mental attainment in individuals whose head measurements (or brain weights) are below the normal averages or even within the limits accepted for microcephalia.

The structures which fill the spaces between the cells may be divided for consideration into the essential nervous elements and the supportive and nutritive tissues. The first group includes the exogenous and endogenous myelinated fibers with their non-medullated terminal arborizations and collaterals and the dendritic expansions of the cells. The myelinated fibers form no small part of the whole mass in certain areas, especially in the lower levels and in some cortices in certain higher laminæ as well. In other levels, however, their number is much less marked and the lamina granularis externa and lamina pyramidalis show a very limited absolute number in all cortices and here it seems probable that the chief intercellular nervous structures are the non-medullated fibrillar elements. The part played by the medullated fibers can generally be readily controlled by appropriate preparations, but the methods for the selective staining of the non-medullated elements are more difficult and less constant, and the tremendous wealth of these fibers in an adult brain would make their accurate estimation a very difficult task.

It proves relatively easy, as a rule, to estimate the spatial importance of the vascular system because of the ease with which it may be stained, and the neuroglia cells and differentiated neuroglia fibrils can likewise, as a rule, be readily demonstrated by selective staining methods. The neuroglia fibrils are, however, relatively sparse in the upper cortex layers except when proliferation occurs in response to inflammation or as replacement, and here another type of supportive framework must be considered. The indistinct diffuse staining of these levels by many methods — notably Mallory's phosphotungstic acid hematoxylin and Alzheimer's modification of Mann's eosin-methyl blue — points to material here which is probably not essential nervous tissue and does not take the characteristic stain of the glia fibrils. Cajal's ammonium bromide-gold chloride method in successful preparations shows a wealth of material here which gives the impression of a very delicate network of fibers or possibly of a plasmatic substance. Unfortunately this stain like the majority of the metallic impregnations is somewhat uncertain and requires, at least in the writer's experience, freshly fixed material for good results. It must be granted, however, that if the results shown in successful preparations by this method reveal the real situation we are here dealing with a material which might go far toward filling the intercellular spaces in a cortex, which was far below normal in its contest of dendrites and termini, and hence distort badly any interpretation based on the relation of cell number to thickness of laminæ.

In the earliest embryonic stages of the nervous system the syncitial supportive tissue, *i.e.*, the spongioblasts of His, tend to develop in advance of the neuroblasts. Streeter states that in some sections a fairly complete spongioblastic framework is encountered in which are found no differentiated nerve cells or fibers. This tendency of the supportive framework to precede the development of the nervous structures is apparent also in the embryonic stages of the cortex, where the well-marked spongioblastic mantle zone and the stratum cribrosum are first developed, into the former of which the nerve cells later push their way by migration from the nuclear layer. Whether or not this order obtains later in the course of the development of the cortex is apparently an unanswered question as yet.

Disturbances of the blood supply in the adult brain, especially in cases where the alteration is that of marked reduction in volume of blood but not a complete stoppage, as for example, the endarteritic form of syphilis, apparently give rise to a differential destruction of the brain substance in which the nerve elements go first, while the neuroglia is preserved and often reacts more or less to fill the loss. More complete obliteration of a vessel gives rise to loss of neuroglia tissue also, while the mesoblastic elements of the vascular framework often remain. In other words, it seems that the nutritive and supportive structures of the cortex are more resistant to at least this type of destructive influence than are the essential nervous tissues. If this order also applies to the effect of an inhibitory moment acting during development, it is easy to conceive of a condition in which the full nerve cell development was hindered, while the proliferation of the supportive tissues went on with relatively little interference. Such a selective inhibition would give either relatively few or poorly developed nerve cells in a disproportionately large amount of supporting matrix. That this may be the actual state of affairs at least in some cases is suggested strongly by a comparison of some of Hammarberg's drawings of imbeciles cortices with his normals (Plate I, Fig. 2, with Plate V, Fig. 2). The imbecile cortex in this case contains 213 cells in a depth of 2.5 millimeters, the normal, 333 cells in 2.97 millimeters, or to express the relation in simpler form, if the imbecile cortex were of the thickness of the normal it would contain about 255 cells as compared to the 333 in the normal, and when one considers that the development of the individual cells of the imbecile cortex is far below that in the normal, and that they therefore probably add a very much smaller complement of dendrites, collaterals, etc., to the intercellular spaces, the conclusion seems unavoidable that the proportion of supportive tissue here must be very much greater. Unfortunately Hammarberg's drawings do not lend themselves readily to such comparison as they are not for the most part sufficiently accurately localized to permit of direct contrast. Hammarberg himself reports in his microscopic examination in a number of cases (especially those of the first group) that the supportive substance is somewhat thicker than normal. With the methods he employed, however, it seems doubtful if this could have been the result of direct observation.

With these various factors in view it at first sight seems like a difficult task to form any estimate of the structural conditions of the cortex in a given case without an almost prohibitive series of comparisons between the results obtained by various selective stains. If, however, we accept as a working hypothesis the probability that the number and complexity of interconnections is correlative to the development of the individual cells, then a three-fold coefficient of correlation (or possibly a percentual expression of the relation) between cortex depth, cell volume (expressed in terms of area) and cell numbers may give a result of value in the defective group. Whether this might also apply to the cases of dementia without cortical devastation remains to be seen.

For such a review sections must be available which are comparable both as to fixation, embedding, thickness and site selected for the counts and measurements. The writer has for his cases adopted the following technique. Fixation: the brain is suspended by means of a string passed under the basilar artery in a solution of 4 per cent. formaldehyde (10 per cent. formalin) at least one month. After this period pieces are removed and run through three changes of twenty-four hours each in 95 per cent. alcohol, absolute alcohol, chloroform, chloroform saturated with paraffin and then left at 55 degrees in 52 degrees C.M.P. paraffin for twenty-four hours. Sections are cut at 10 μ and stained in thionin or toluidin blue.

The choice of area for measurements is of importance. Bolton has laid emphasis on this point and considers that for estimates as to cortex depth it is necessary to measure the crest, sides and sulcal regions of a convolution and take an average. This factor would be greater in narrow convolutions than in those of greater width, and hence in brains of greater complexity than in those of more simple pattern.

Another factor is that of the angle made by the section to the surface of the convolution. Thus theoretically a section cut diagonally through a cortex 3 millimeters deep in a block 2 millimeters thick would yield an error of about .6 millimeters (20 per cent.), and while it is highly improbable that such obliquity would occur in a carefully cut and embedded block it seemed advisable to control it by direct measurements. For this purpose a special block holder was devised, which rotates about its horizontal axis and which is equipped with a scale graduated in millimeters, so that from a wedge-shaped block of cortex cut so that its central plane is as nearly as possible perpendicular to the surface, seven or eight planes of section can be made cutting the cortex at as many different angles. All measurements have been made at the apex of convolutions through the strip where the axes of the majority of nerve cells pass vertically into the white matter. Some of the measurements were made with a micrometer eyepiece, but the majority have been made by means of a 45° mirror on the microscope of a convertible balopticon with lenses and table height adjusted to give a magnification of 500 diameters. A specially constructed mechanical stage makes it possible to follow the selected axis and each field is measured either by means of a millimeter scale or millimeter cross section paper, their sum forming the cortex depth. Section groups of this type have been cut from ten blocks, five of which representing five major cortical fields are given here in tabular form: —

CORTEX SECTION NUMBER.	PCL.		PoCL.		F.		T.		Occ.	
	Millimeter.	Per Cent.	Millimeter.	Per Cent.	Millimeter.	Per Cent.	Millimeter.	Per Cent.	Millimeter.	Per Cent.
1, ...	4.38	45.5	–	–	4.	47.3	4.20	56.2	–	–
2, ...	3.23	7.3	3.70	30.1	3.97	46.3	3.26	21.5	–	–
3, ...	3.09	2.6	2.96	4.2	2.93	7.8	2.77	3.3	4.41	119.4
4, ...	3.01	0.0	2.85	0.4	2.72	0.0	2.68	0.0	2.10	4.4
5, ...	3.11	3.3	2.97	4.6	2.84	4.4	2.96	10.4	2.01	0.0
6, ...	3.28	8.9	2.84	0.0	3.21	18.1	3.37	25.5	2.40	19.4
7, ...	4.06	34.8	3.20	12.6	3.65	34.4	3.82	42.2	2.60	29.3
8, ...	–	–	4.02	41.3	–	–	–	–	3.11	59.7

The PCL. block was from the precentral convolution immediately below the point of incidence of the great annectant buttress. The PoCL. block from the postcentral convolution opposite the PCL. block. The frontal block was from the posterior end of the first frontal gyrus and represented a part of the agranular frontal type of cortex. The temporal block was from the mid portion of the Sylvian border of the superior temporal gyrus about opposite the Rolandic operculum. The occipital block is calcarine cortex from beneath the sulcus calcarinus proprius near its point of bifurcation.

The percentages have been based in each instance on the shortest measurement to show the variation from this brought about by the change of angle.

The wedge-shaped pieces of cortex were from 8 to 12 millimeters long on their superior surface and of the width of the gyrus from which they were taken, so that the steps of the series are from 1 to 1½ millimeters apart on the surface and roughly coincident at the apices, so that the first step on either side of the vertical would probably represent the maximum error which would occur in a carefully cut and mounted block of from 2 to 3 millimeters thickness. With the exception of the postcentral the steps, while varying markedly in value, yet show a regularity of direction on each side of the section of least depth. The postcentral shows a condition which was encountered in one other block of the series, which bespeaks apparently an irregularity of depth.

One disturbing element in the measurement is that of determining exactly the point at which cortex ends and medulla begins. In practically every case the spindle cells of the lowest cortical layer disappear rather gradually as the white matter is reached and individual cells of this type may frequently be seen singly or in pairs well below their neighbors, so that the establishment of a lower border is more or less of an arbitrary one. A part of the variation between pairs of measurements on either side of the zero may result from this, and in order to estimate its value five determinations were made at widely separated intervals of the depth of section 4, of the PCL. block, with the result that the readings varied from 1.4 per cent. above to 1.5 per cent. below that recorded, a total error of 2.9 per cent., which is greater than the smallest error referable to obliquity shown in the table and approximates two others. As these cells in common with all the cortical elements find their adult position by migration from below, it is highly probable that this error may prove a very variable one in brains from various sources, and especially in those which have been influenced by some factor inhibiting full development.

The greatest variation between a section of least depth and its nearest neighbor is that shown in the Occ. block, *i.e.*, 19.4 per cent. The average variation in the whole series of ten blocks was 5.98 per cent., while in those included in the table it is 6.14 per cent.

The cyto-architectonic picture is not much altered except when the obliquity is marked. The individual laminæ according to a few careful measurements seem to be increased in width proportionately to the change in total cortex depth. In only one observed instance, however, does this tend to modify the picture. This is in the level occupied in other fields by the stellate cells in the precentral and agranular frontal cortices where the widening of this zone increases the prominence of the scattered stellate elements, though it is hardly probable that they would be mistaken for a true lamina granularis interna. A further influence of obliquity is seen in the pyramidal cells. In the vertical section by far the larger proportion of these are cut so that they show long apical processes, and as the plane deviates from the vertical those showing long processes become less in number and the short truncated forms more numerous. There is, however, an apparently fairly wide variation in the vertical orientation of these cells, so that their shape will not serve as an accurate control over the obliquity. A few observations of the accuracy of this control have been made by determining the proportion of truncated cells to those with long processes and it seems probable that degrees of obliquity giving rise to 10 per cent. or more of error could be recognized in this way. This same factor of variation in form will probably act to reduce an estimate of cell volume based on measurement of cell areas, and hence might play a part in the use of such data for determining the correlation suggested above. Further observations on this point are intended.

In general the results show that sections for comparison must be cut and mounted with extreme care to avoid undue obliquity and that with such care one may expect an error of something under 6 per cent., of which almost one-half is due to difficulty in determining the line of demarcation between cortex and medulla.

A STUDY OF THE NEUROGLIA IN A CASE OF SARCOMA OF THE BRAIN.

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Recent studies have shown that the neuroglia is no longer to be regarded as playing only a passive part as a supporting tissue, but that it plays various other active rôles. It is especially prone to proliferate under inflammatory conditions and in various pathological states, and this tendency is probably more marked in the neuroglia than in any other type of cell in the body, and it is seen especially well in new growths in the brain. Exactly what the exciting cause of this increase in number of cells and fibers is, and what is the part played by the proliferated cells, can be determined only by further study and improved histological methods.

The study of the neuroglia, especially in cases of the so-called reactive gliomatosis, is an extremely interesting one, and it is to be hoped that in time some light may be thrown on the various functional activities of the cells by means of investigations made of their various pathological manifestations. The types of cells vary greatly even in the same process, and we are yet ignorant of the part played by each type and of their importance to the organism.

In the following article, an attempt is made to describe the various neuroglia cells which were found in various parts of the brain in a case of sarcoma, which ran a comparatively rapid course, leading to death within eight months after the first symptoms were noted.

The following is an abstract of the clinical history of the case studied: —

H. M. S., white, male, age forty-nine, farmer, of English-Irish descent. Patient was a normal child, his physical and mental development were normal. Normal birth, no history of any illness during childhood obtainable. Adolescence was normal. No sickness or weaknesses discoverable. High-school graduate, one year college work. A good reader and thinker. Sociable, and a sensible church worker. No eccentricities. Height, 5 feet, 6½ inches. Weight, 160 pounds. Bluish gray eyes, brown hair, clear healthy skin. No venereal diseases, no alcohol, no tobacco. Regular habits in eating and sleeping. Three living brothers,

— ages fifty-nine, fifty-four and forty-seven, — all healthy men, the one aged forty-seven being somewhat eccentric. They all have normal children. One brother died in infancy of bowel trouble, and one, aged twenty-four, of typhoid fever. One living sister, age 56, normal and healthy with normal offspring. No sisters dead. Father of English parentage, farmer, healthy and normal, no alcohol or venereal disease. He died at the age of seventy-eight with fractured femur. Mother healthy, except for mitral insufficiency, died at age of eighty-four of cardiac dropsy. She was of Irish parentage. The history of the aunts and uncles reveals no insanity, epilepsy, alcoholism or tuberculosis. About 1905 the patient had an infection of one deep cervical gland which was drained, and while resolution was slow, it seemed to be perfect. He was married, wife living and healthy; living children, as follows: male, twenty-one, four female children, ages nineteen, seventeen, sixteen and twelve, all normal. No children dead.

The present illness began apparently in January, 1915, at which time he slipped on an icy cement step, striking severely on his occiput. There was no unconsciousness, no noticeable eye symptoms, no headache or vomiting following this fall. However, between this time and June, 1915, he had two attacks of muscular twitchings of the left thigh and one attack affecting the left arm.

He visited a physician, June 8, 1915, saying that he had fallen from a fence while walking on the top board, which was about 3 feet high. He had sprained his wrist slightly, and thought that it did not amount to much, but his left arm and leg felt heavy. A slight contusion of the skin over the right tempero-frontal region indicated where his head struck the ground. He could not remember that he had any vertigo that caused him to fall, but said that after the fall he was dazed for a couple of minutes, but soon went on his farm overseeing his work. The fall had occurred on June 3, 1915.

On June 11, 1915, he again called on his physician, saying that there was more heaviness and numbness of the arm, and the examiner found a perceptible dragging of the left leg. He could walk a straight line, no Romberg symptom, no inequality of the pupils, normal light and accommodative pupillary reflexes. There was no headache, no vomiting, no squint. Temperature, normal; appetite, sleep, kidney and bowel action were normal. The left patellar reflex was slightly increased, the skin reflexes were normal.

He was seen again on June 15, 1915, and ordered to stay in bed. His general symptoms were about the same, except for a slightly increasing numbness of the right arm and leg, and a noticeable lack of co-ordination of the arm movements. Chemical and microscopical examinations of the urine were negative. Blood pressure: systolic, 130, diastolic, 90. Temperature, 99.2. From this time on, the patient had a steady progressive increase of the arm and leg pareses. No other muscles were involved. Taste sense normal, and hearing and intellect were good, except for the gradually increasing stupor. He remained with his eyes closed practically all of the time, with almost a smile on his face, complaining of nothing, asking for nothing, accepting food and drink when offered, and answered simple questions. When asked any questions which required any effort to answer, he would say ,"Don't bother me with it. I am out of it."

At the time when the muscular pareses were at a stage that he could not of his own volition use his arm, he could raise it at the command of another. At a later period when this was not possible, a deep sigh or stretching would make it possible for him to raise the arm. Finally, there was a plastic paralysis of the arm and leg. The great toe showed a sluggish Babinski reflex. On and after the fifth week, urine was voided involuntarily. Bowel movements were sluggish and the bowel was emptied by the use of glycerine enemata. The last four weeks before death, he could talk only in a whisper. For a period of about two weeks in the early part of July, the patient would grasp the corner of his pillow, and give it a rhythmic, easy jerk for hours at a time; again, with his index finger he would scratch his chest or nose for long periods. This was all done with his right hand. He died from exhaustion, Aug. 15, 1915.

The brain only was removed for examination.

Gross Description. — The right hemisphere containing the tumor was received at the laboratory on Aug. 18, 1915, in 10 per cent. formol. On the mesial surface was seen a grayish mass projecting about 1 centimeter above the surface. The edges of the mass were ragged and the line of demarcation between the tumor and brain substance was plainly seen. The tumor lay just above and partly involved the body of the corpus callosum, extending upwards a distance of 5 centimeters, and also involved the gyrus cinguli and the lower part of the paracentral lobule. Anteroposteriorly the tumor measured 4 centimeters. The genu and the splenium of the corpus callosum were not involved in the growth.

The tumor was covered with a thin membrane, which resembles the pia, but the pial vessels cannot be traced beyond the edge of the tumor. Many small vessels are seen on the surface and can be traced for short distances, but are soon lost. No hemorrhagic areas are seen.

On section of the brain 1 centimeter posterior to the tip of the temporal lobe the roughened cut surface of the tumor is well seen. There is everywhere a fairly sharp line of demarcation between the gray tumor and the brain tissue. The tumor tears away from the brain tissue easily, and in examining it some tears are made. Below, at the junction of the tumor and callosum, the tumor shows rather a greenish, gelatinous appearance, and this part shades gradually into the white matter of the callosum. The ventricle is flattened, and the lenticular and caudate nuclei are pushed downwards and flattened.

The second section was made 2 centimeters posterior to the first. Here the line of demarcation between the tumor and brain tissue is much more marked. Above, there are numerous blood vessels at the border of the tumor, while externally there is a somewhat yellow, softened area between the tumor and medullary brain substance. The third section, made 2 centimeters posterior to the second, shows practically the same sort of demarcation.

The cut surface of the tumor is grayish in color, with many dark spots representing the cut surface of blood vessels. The vessels are most numerous at the periphery, where in places they form a dark border to the tumor. No definite areas of softening are to be found in the tumor. Below, at the junction with the corpus callosum, is found a light green area, gelatinous in consistency, which seems translucent in thin section. This area measures roughly 3 millimeters high by 5 millimeters long and grossly shows no structure.

The white matter surrounding the tumor is much softened and is almost semifluid in consistency. When a section of the hemisphere is laid in a horizontal position, one notices a definite depression due to the sinking of the softened white matter. This is shown in Fig. 1 where the depression is seen as a black shadow in the medullary substance.

Microscopic Examination.

Technique. — For the demonstration of the neuroglia, various methods have been employed. Merzbacher's Victoria blue method with frozen sections has been most extensively used. Mallory's phosphomolybdic-hæmatoxylin and Mann's methyl-blue eosin, as modified by Alzheimer, have also been employed. Cajal's sublimate-gold method was also of value. Scharlach R was used for the demonstration of lipoid material and Bielschowsky's silver method was used for neurofibrils.

Paraffin sections were stained in hæmatoxylin and eosin; hæmatoxylin and Van Gieson and the various aniline dyes, thionin, toluidin blue and cresyl-violet were used for nerve cells. The elastic fibers of the blood vessels were stained by Weigert's resorcin-fuchsin method.

I. Specimens from the Center of the Tumor. Fig. 1 (1).

The specimens stained with the various neuroglia stains were all pale with the exception of small areas, which, as a rule, stained rather deeply blue.

Under the low power, it is seen that the greater part of the section is made up of tumor cells while only in the small blue areas are any cells with fibers seen. The tumor cells are only slightly tinged with blue in the well-differentiated specimens, but many of them show many darkly staining granules in the cell protoplasm. In the Scharlach specimens, many fat droplets are seen in these cells.

Under higher magnification the small areas are found to contain masses of neuroglia cells and fibers, which form a dense network almost filling the space. Neuroglia cells are found only in these circumscribed areas. Some of the cells are quite large and their fibers are markedly thick, while others are small and give off thin fibers. The following types of cells may be found: —

1. Large, more or less rounded, cells with a comparatively small eccentrically placed nucleus. The cell body is comparatively large and in it are seen many small, dark, round or rod-like granules which are stained a deep blue. Some of these, especially the rod-like variety, resemble parts of fibers which run through the cell, but no definite fibers can be traced from the processes through the cell. The fibers run in all directions from short processes, weave themselves between other fibers in the neighborhood, and may be followed for varying distances. The fibers differ somewhat in size, even in those coming from the same cell, although the majority seem to be of the same caliber. It is possible that this apparent difference in size is due to some fibers being more differentiated than others. A few of the fibers seem to run directly from the cell body, but the majority proceed from short, protoplasmic processes. In the Scharlach specimens, many of these cells show fatty granules in the body protoplasm.

2. Small, round cells of the same general shape as those noted above. The body protoplasm, however, stains more deeply and the nucleus is not nearly so sharply differentiated. Some of these cells show a light, round spot in the cell body, somewhat resembling a vacuole, the exact nature of which was not determined. The fibers are thin and seem to extend directly from the cell body. They are of considerable length and may be traced for a comparatively long distance weaving in and out of the fibers from the surrounding cells. The network formed by these fibers is not so dense as that formed by the cells of type 1.

3. Small, spindle-shaped cells, with darkly staining, centrally placed nuclei, are found especially frequently near the periphery of the area. The fibers are thin and run tangentially, so that they help to form a fibrous network between the tumor cells and the area.

4. Scattered through the network, one finds large round or oval nuclei about which no protoplasmic body can be found nor can any fibers be seen running from them. They contain many fine, bluish granules, which are especially numerous about the periphery, but may also be found in the central portion. In size, in general contour and general arrangement of chromatin elements, they resemble the nuclei of the large cells, but they differ in not possessing a cell body and fibers.

In the specimens stained with Scharlach R, numerous fatty granules are seen in the cells of all the types. In the larger areas, one occasionally finds a rather large droplet lying alone without any visible cell body or nucleus near it. This probably represents a cell which has entirely undergone degeneration.

In only one of these areas could a blood vessel be found. This vessel showed considerable fatty degeneration of its walls and contained only a few red blood cells.

With the stains used, nothing could be seen that resembled an axis-cylinder process.

The areas were not numerous, there being only three or four in a section. They are entirely surrounded by tumor cells and probably represent bits of brain tissue which have become enclosed and are undergoing degenerative changes. The large fibers and cell bodies may represent a reaction to the toxines formed by the tumor or may be simply a change in the nature of the cell before it finally degenerated.

II. SPECIMENS FROM THE MARGIN OF THE TUMOR AND THE CORPUS CALLOSUM. FIG. 2 (2).

The connection of the tumor to the corpus callosum is a very loose one, and frozen sections showing both structures are obtained only with difficulty. The margin of the tumor is made up of blood vessels which have little connective tissue supporting them, and consequently they break apart very easily. The tumor cells surround the vessels, but do not infiltrate the corpus callosum, but instead advance by pushing away the structures in front of them.

Just beneath the layer of blood vessels belonging to the tumor is a rather thick layer of finely interwoven neurogliar fibers of comparatively small caliber. The fibers tend to run in a general direction tangentially to the margin of the tumor, but a considerable number weave about in all directions. In the mass of fibers are seen quite a large number of neurogliar nuclei about which no protoplasmic body can be seen.

Deeper in the body of the corpus callosum, there is found a slight increase in the number of neuroglia cells. For the greater part these cells are of the bipolar, spindle-shaped variety with fibers extending from the poles and the nucleus occupying the center of the cell. The fibers extending from these cells are thin and may be followed a considerable distance. Comparatively rarely are found small, round nuclei about which is seen a thin layer of protoplasm from which radiates a number of long, thin fibers.

None of the neuroglia fibers in the body of the corpus callosum are of great diameter, and their caliber is the same throughout their entire extent.

No blood vessels are seen in the substance of the corpus callosum in any of the sections.

III. SPECIMENS FROM THE EDGE OF THE TUMOR AND THE CORTEX. FIG. 2 (3).

Above the superior surface of the tumor is a small tongue of apparently normal cortex which forms a sort of roof over the tumor. This brain substance does not extend completely to the mesial surface of the tumor, but only fills in the outer angle formed by the curved outer surface. With the low power it is seen that the margin of the tumor is very vascular and that the tumor cells, which apparently originate in the adventitia of the vessels, are in an active state of proliferation. (Fig. 6.) Some are giant cells with several nuclei, while others show two nuclei. Mitotic figures are seen in a number of the cells.

No enclosed areas of neuroglia cells and fibers, such as are seen in the central portion of the tumor, are to be found in this region.

In the white matter outside the tumor area, large numbers of neuroglia cells and fibers may be seen with the low power. In the gray matter, few fibers are seen except in the outer layers of the cortex.

With higher magnification, a considerable number of cells with protoplasmic processes and fibers are to be found. The outer layers show a great increase in the number and size of the neuroglia cells. The fibers are fairly large and form a thick network weaving in and out among themselves. The so-called marginal zone is quite thick and is formed of a dense network of large fibers which form a considerable mat over the surface of the brain. These fibers are of larger caliber and stain more deeply than those forming the network in the layers lying below it.

The following types of neuroglia cells may be differentiated: —

1. Large, irregularly shaped cells with an eccentrically placed nucleus and many fibers which usually radiate from a rather large protoplasmic process. The nucleus is oval and stains fairly deeply. The cell body stains more lightly and is quite irregularly formed, resembling somewhat an amœba in shape. The protoplasmic processes extend outwards and from their extremities run deeply staining fibers which may be traced for varying distances into the brain substance. After leaving the processes, the caliber of the fibers remains the same as far as they can be traced. Some of the cells apparently belonging to this group, have more rounded and less irregularly shaped cell bodies, and in these the protoplasmic processes are not nearly so long. In some of these cells, collections of pigment may be found.

2. Much less numerous are rather long, spindle-shaped cells with a central nucleus and a protoplasmic body. The body of the cell at the middle is only slightly larger than the nucleus, but it may be distinctly seen at the ends of the nucleus where it extends outwards as a protoplasmic process, from which arise several fibers. Some of these cells are quite spindle-shaped and taper at the ends, others have blunter ends and several fibers arise from each end.

3. In the white matter, and especially numerous in the gray matter, are found round or oval nuclei with only a narrow rim of protoplasm about them. The nuclei contain many chromatin granules placed, for the most part, at the periphery. The cell body stains very lightly blue in the Merzbacher specimens, and in some cells cannot be distinguished at all. In some, a faintly staining protoplasmic body may be seen only at one side of the nucleus. In the gray matter, the body of many of the cells cannot be seen, but the nucleus is surrounded by a clear area in which the body may be said to be.

The nerve cells in the cortex show few degenerative changes which are demonstrable in the Merzbacher specimens. The nucleus is centrally placed and the nucleolus stains well and is not abnormally shaped. The cell body shows no vacuolization, but a few cells show an increase in the pigment masses.

Blood vessels are not numerous in this part of the cortex, and their walls show nothing especially abnormal.

IV. SPECIMENS FROM THE SOFTENED MEDULLARY PORTION. FIG. 1 (4).

The white matter surrounding the inner side of the tumor was in a much softened condition and on section one saw a marked sinking in this area when the cut surface was placed in a horizontal position. After hardening in formol, the part was more solid than at first, but was still of a putty-like consistency.

The sections all showed a very marked increase of the neuroglia cells, even under the low power. The sections, stained according to Cajal's sublimate-gold chloride method, show an enormous number of cells, round and pyramidal in shape with processes extending in all directions. (Figs. 3 and 4.)

The Merzbacher specimens under the low power show a great number of large, irregularly shaped cells with thick processes, cells more or less round with thin processes, and nuclei without visible cell bodies and spindle-shaped cells with centrally placed nuclei.

With the higher powers, the following types of neuroglia cells are seen:—

1. Very large, irregularly shaped cells with small nuclei and large protoplasmic cell bodies and processes. The nuclei are eccentrically placed and contain much chromatin material which stains dark blue. The cell bodies stain a lighter blue and the protoplasm is usually homogeneous in structure, but in a few cells one sees darker staining masses which would indicate a more dense structure. The protoplasmic processes are large and from the ends of them radiate a large number of fine fibers which extend outwards in all directions. After leaving the processes, the fibers retain the same caliber throughout their extent. A few fibers may be seen running in the substance of the protoplasmic processes and occasionally a few are seen running through the cell body. The cells of this type vary considerably in size and shape, some of the cell bodies being round, some ovoid and others of an irregular, quadrilateral outline. All of them, however, have a large number of fibers arising from various parts of the cell. In some of the cells, two nuclei may be seen, but no mitotic figures were found.

Under the higher powers it is seen that the cells which under low power showed very thick, dark-blue processes and the round cells with many processes belong to practically the same group. The bodies of some of the cells, being more pale, were not visible under the low power.

2. Spindle-shaped cells with centrally placed nuclei and rather dark staining protoplasmic bodies and processes are quite numerous. They are long cells, the nuclei occupying nearly all the center of the cell body with only a narrow rim of protoplasm on the sides. The processes are placed at each pole and from each of them several fibers are given off. The fibers are thin and quite long, many of them being traced for a long distance across the field.

3. Large numbers of round or oval nuclei with a small protoplasmic cell body surrounding them, or without a visible cell body, are very numerous. These nuclei vary somewhat in size and staining qualities, some staining

rather lightly and others in the same neighborhood taking a heavy stain. These nuclei all contain much chromatin material arranged rather symmetrically.

The cell bodies stain a light blue with Victoria blue, but in them one may find certain granules which stain more darkly than the surrounding protoplasm, but not so deeply as the chromatin granules in the nuclei. The granules are very fine and are scattered without order in the body protoplasm.

In some of these cells the body protoplasm is seen only on one side of the nucleus; in others a small rim is seen on one side and a fairly large mass on the other. About a few of the nuclei, one sees a clear space bounded by a thick, darkly stained, narrow ring, which probably represents the outline of the cell body, although no structure is visible between the ring and nucleus.

4. Cells with small nuclei are placed at the end of rather a large protoplasmic body. The nucleus is oval and contains a considerable amount of chromatin granules. The cell body is fairly large and there are many fine fibers arising directly from it or from short protoplasmic processes at the end of the body opposite the nucleus. The fibers are very fine and short, and none are seen running into or through the cell body. These cells are found in fairly large numbers throughout this area. They vary in size, but the form remains fairly constant. Occasionally, small granules are seen in the cell body.

In every field are found heavy, darkly staining, wavy processes, the axis cylinder processes of the nerve cells in the cortex.

In Scharlach preparations, a great amount of fatty degeneration is seen in the neuroglia cells. The fat droplets are arranged about the nucleus and in some instances are of quite considerable size.

V. Specimens from the Caudate Nucleus and Internal Capsule.

Fig. 1 (5).

In these specimens the blood vessels are seen in much greater numbers than in any of the preceding group. Only along the ventricles, however, do they show a great increase in the neuroglia fibers surrounding them, but there they show a thick, matted network of fibers running in a circular fashion about the wall and forming a much thickened wall.

The neuroglia cells are numerous, but little except nuclear structure can be distinguished except along the border of the ventricle.

One sees many oval or round nuclei containing many chromatin granules, but with little or no cell body surrounding. Many fine fibers are seen running in all directions away from the nucleus and often one is able to trace fiber from one side of the cell to the other as it passes along the side of the nucleus. These fibers vary in length but their diameter is the same throughout their extent. In the depths of the section, these fibers are not closely woven together, but as one approaches the border, one sees a thick mass of fibers lying just under the layer of ependymal cells.

These fibers are of about the same diameter as those in the central part of the section, but are much more thickly woven together.

In the meshes of the network are found a large number of nuclei, round or usually oval, which are not surrounded by any visible protoplasmic body. These nuclei are comparatively large as a rule, but many are quite small.

The ganglion cells seen in this section all contain considerable pigment in the cell body, and in many the nucleus is displaced by the mass. The nucleus is often irregularly shaped and stains irregularly. In the Scharlach specimens, a marked degree of fatty change is seen in the cells.

The blood vessels are small and the wall is formed of a single layer of endothelial cells for the greater part. The cells show considerable vacuolization and in the Scharlach specimens, fatty degeneration is quite marked.

VI. Specimens from the Optic Thalamus. Fig. 1 (6).

In the specimens stained with Victoria blue, a considerable increase in the number of neuroglia cells is seen. The cells, as a rule, have no visible protoplasmic body, but radiating from them one sees numerous fine, blue fibers, many of which can be traced from one side to the other running by the side of the nucleus.

A certain number of the nuclei, however, are surrounded by a protoplasmic body from which project protoplasmic processes which give rise to fibers which pass outwards and interweave with other fibers. The bodies are stained a light blue and are small, extending only a short distance beyond the border of the nucleus. The processes are quite faintly stained and are short, extending only a very short distance from the cell body. The fibers are thin and are of the same caliber throughout their length.

Blood vessels are numerous in this region, but about none of them does one see any large number of neuroglia cells or fibers.

The ganglion cells in these specimens show many evidences of degenerative change. Practically all of them contain large masses of yellowish-brown pigment, the nucleus stains very darkly or lightly and apparently contains many vacuoles. In a few cells only a few chromatin granules are left in the nucleus and the nucleolus is entirely destroyed. Dark granules are scattered through the cell body, but no definite chromatin masses are found. Large globules of lipoid material are seen in specimens stained with Scharlach.

Sections from the parts of the brain some distance from the tumor and the surrounding softened area showed nothing abnormal. Blocks cut from the frontal, precentral, postcentral and temporal areas were frozen and sections stained according to Merzbacher's method. The cortex and some 5 millimeters of white matter were included in these sections. In the frontal and precentral areas, the neuroglia cells stained perhaps a little more easily than was usual; that is, good specimens were obtained more frequently, but the cells showed nothing abnormal either in number, size or fibers. The marginal neuroglia were well marked, but no especial increase in the number of cells or fibers was noted.

SUMMARY AND DISCUSSION.

We have a man of forty-nine years dying some eight months after the appearance of the first symptoms pointing to a brain disorder. At autopsy, a large tumor was found on the mesial surface of the right hemisphere. On section, this tumor was grayish in color, solid and fairly sharply differentiated from the surrounding structures. The white matter surrounding the tumor is softened and is almost semifluid in consistency.

Microscopical sections show the center of the tumor to be made up of spindle-shaped cells, for the most part, while at the periphery, active proliferative changes are seen. These changes are especially well shown about the blood vessels, where many multinuclear cells are found.

Sections of the tumor stained with the specific neuroglia stains show small areas in the tumor containing neuroglia cells and fibers. These cells are undergoing degenerative changes and the fibers are quite large.

In the softened medullary part of the brain, a great increase in the neuroglia cells is seen. These cells are of various types, some without fibers and in form somewhat resembling amœbæ, others variously shaped astrocytes, and a third group with extremely large cell bodies and processes.

Some objection might be made to grouping these last cells among the neuroglia cells, but they have been placed there because they occur in large numbers in tissue, which is the seat of a marked neurogliar proliferation; they are not of the same shape as the tumor cells which are seen in the hæmatoxylin and eosin specimens, and they stain actively with the specific neuroglia stains, which the tumor cells do not. The fibers are large, but they do not have the elongated cone shape of the sarcoma cell fibers.

At the border of the tumor are numerous blood vessels about which the tumor cells are most numerous and it is easily seen that the growth of the tumor is along the vessels. In the tissues outside this line of vessels are found some tumor cells, but these cells are rather more cylindrical in shape, the nucleus is more centrally placed as a rule, and the protoplasm and fibers do not stain well with Victoria blue as do those of the neuroglia cells. The number of these cells seen in the Merzbacher specimens is much greater than the definite sarcoma cells seen in specimens stained with hæmatoxylin and eosin.

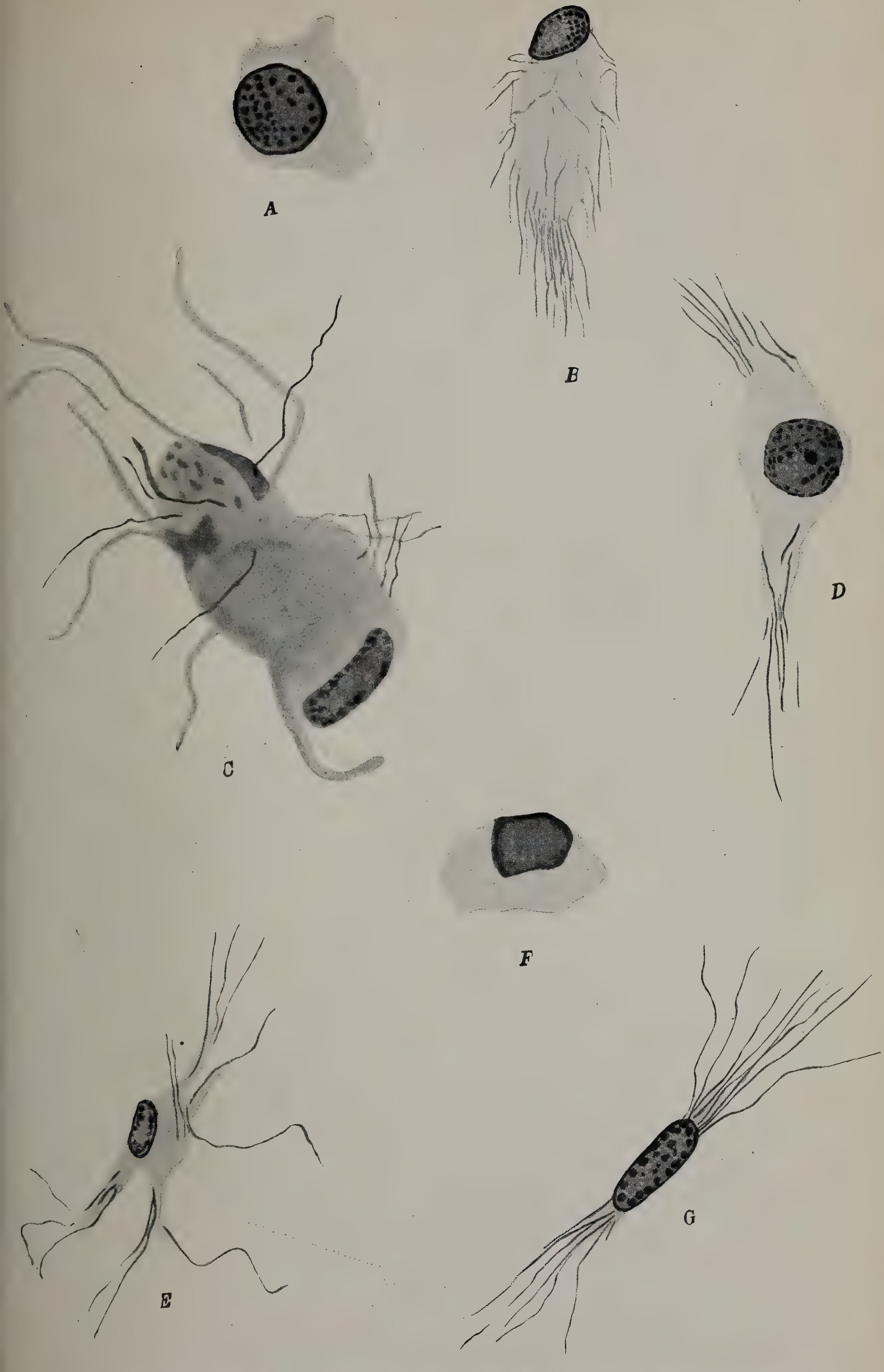
In the case reported by Merzbacher and Uyeda,[1] the gliomatosis was much more marked than in the present instance and the question of a gliosarcoma was raised. As differential diagnostic points, the authors give the following: (1) The method of growth: infiltrative growth of the glioma and expansive growth of the sarcoma; (2) the presence of medullated nerve fibers in the glioma, especially in the central portions; (3) the relation of the pia to the tumor: in the sarcoma the pia stands in a very intimate relationship to the process and often cannot be separated from it; not infrequently the sarcoma springs from the pia; (4) the sarcoma is frequently disseminated along the vessels and especially by the perivascular lymph spaces. According to Borst, this perivascular proliferation speaks especially for sarcoma; (5) most important is the morphology of the cell, especially of the processes. In the sarcoma cells, many rayed, stiff fibers of the same caliber are never seen as they are in glioma cells. The fibers of the sarcoma cells decrease in thickness as they proceed and show many bendings, crooks and kinks.

The types of cells in the medullary part of the brain differ in size, shape and number from the cells which one normally finds there. In parts, at some distance from the tumor, no noticeable abnormalities in the cells are seen. This fact would indicate conclusively that the growing tumor is responsible for the increase in number and variations in types of the cell.

The rapidly growing tumor naturally causes considerable increase in intracranial pressure and must affect the nutrition of the surrounding parts to a considerable extent. Besides this, it is possible that some chemical irritant produced by the sarcoma might also produce great changes in the tissues, as well as acting as a cause of proliferation of the neuroglia.

That the neuroglia is a tissue whose only function is to fill up vacant spaces and to act as a supporting tissue, as Weigert thought, has been disproven by many of the recent studies on the question. The phagocytic activity of the cells has been demonstrated by Alzheimer, among others, and it is extremely probable that in the present case the increase of cells in the softened medullary part is due in great part to this function of the neuroglia. Many of the cells lack fibers and it is possible that these cells, especially, can assume the action of phagocytes. The large cells with large fibers may be neuroglia cells in a stage of dissolution. They stain rather diffusely; the cell body stains unevenly and contains granules which stain dark blue with Victoria blue.

PLATE III.



Neuroglia cells. Figs. *A*, *B*, *C*, *D* from area 4, Fig. 1. Figs. *E*, *F*, *G* from area 3, Fig. 2. Drawings made from Merzbacher preparations, ocular 4, objective, immersion 1/12.

PLATE IV.

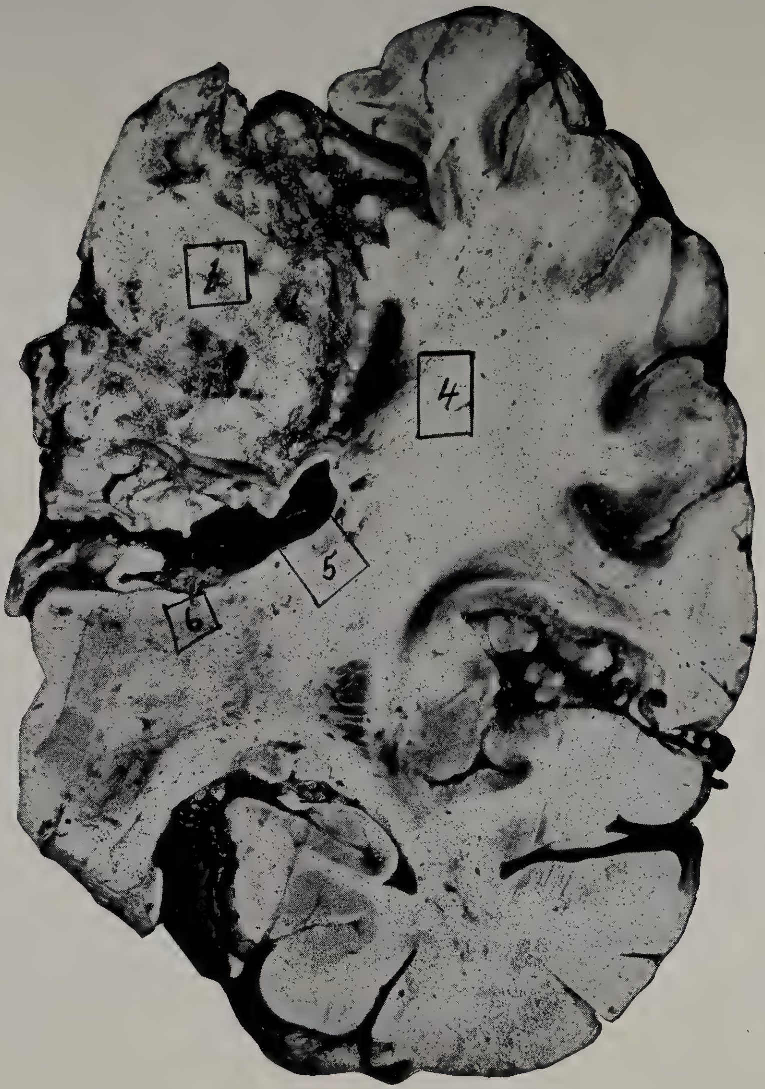


Fig. 1. — Section through middle of tumor.

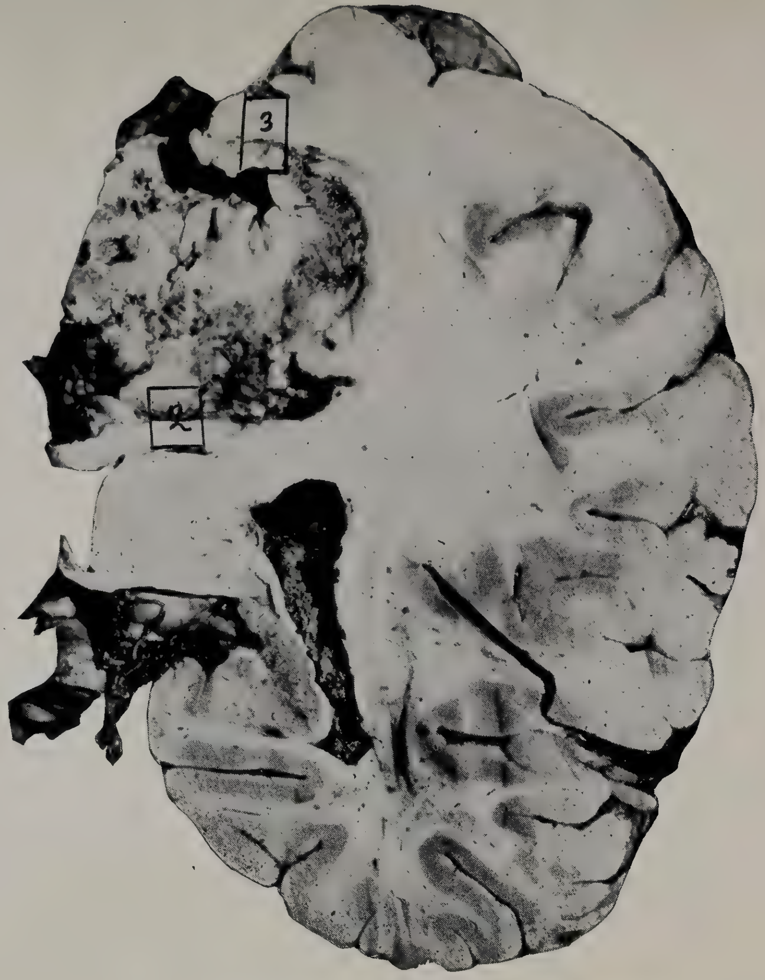


Fig. 2. — Section through posterior third of tumor.

PLATE V.

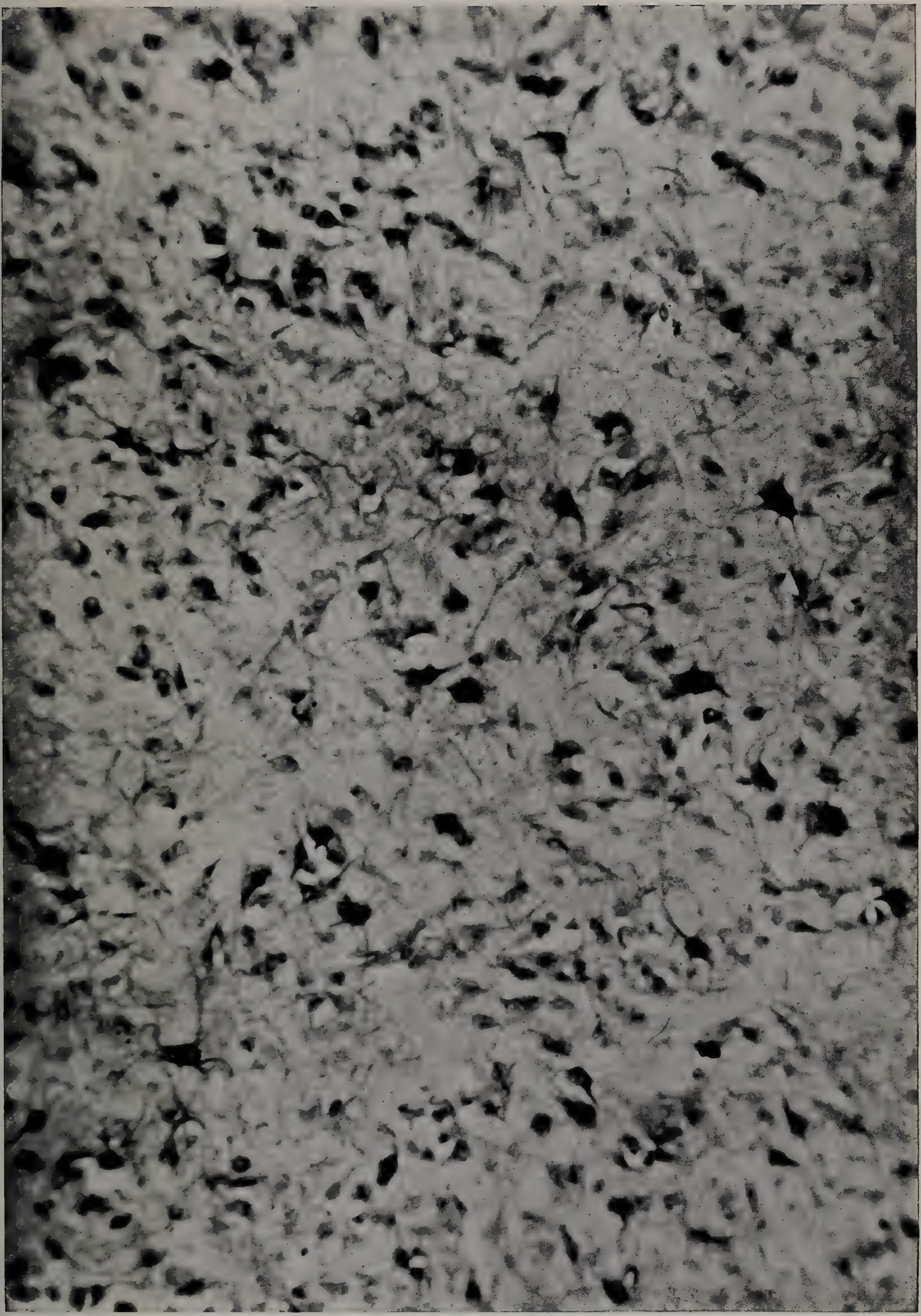


FIG. 3. — Microphotograph. Medullary portion of brain, 4 Fig. 1. Zeiss objective *aa*, ocular 12.

PLATE VI.

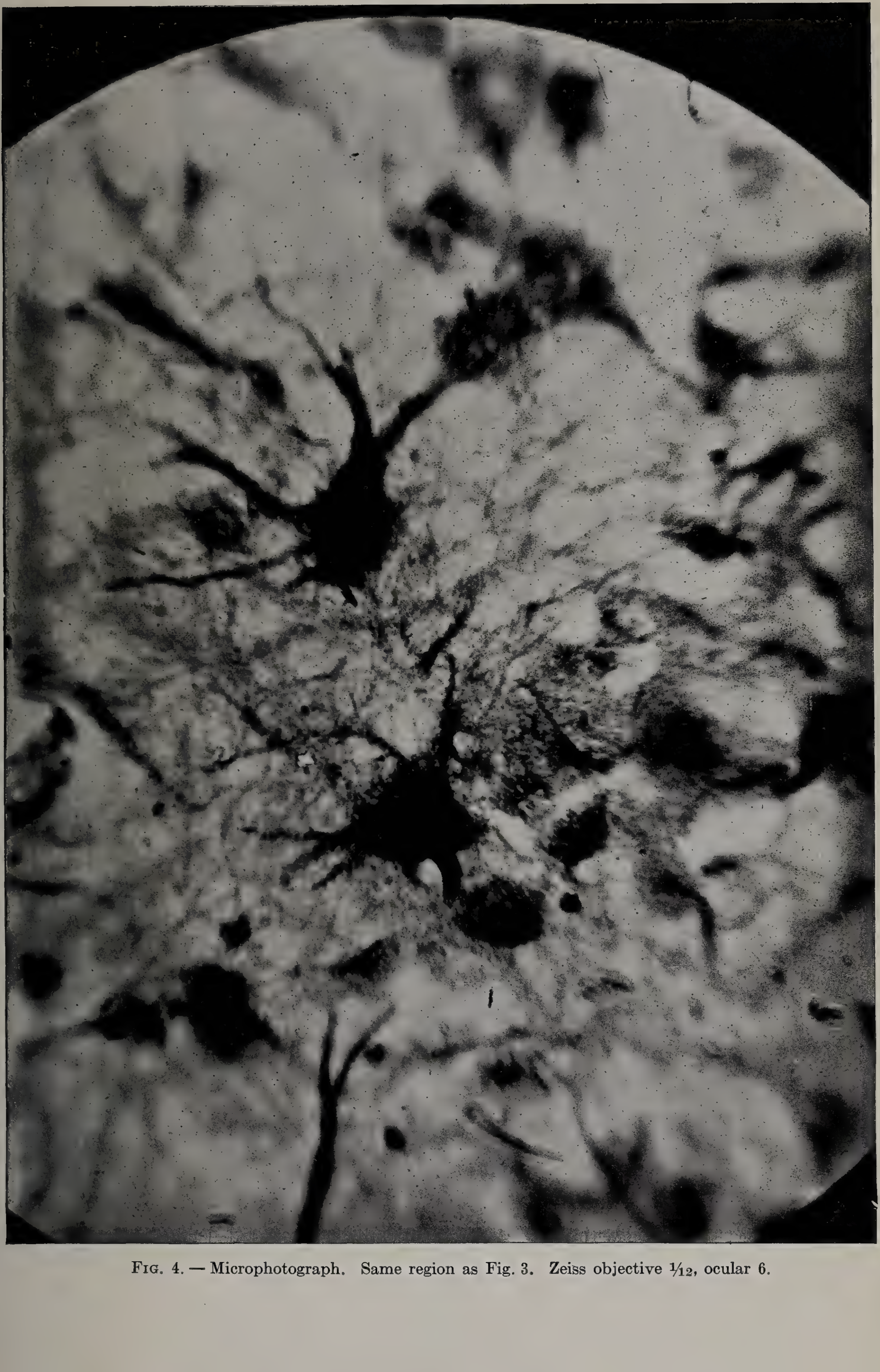


Fig. 4. — Microphotograph. Same region as Fig. 3. Zeiss objective 1/12, ocular 6.

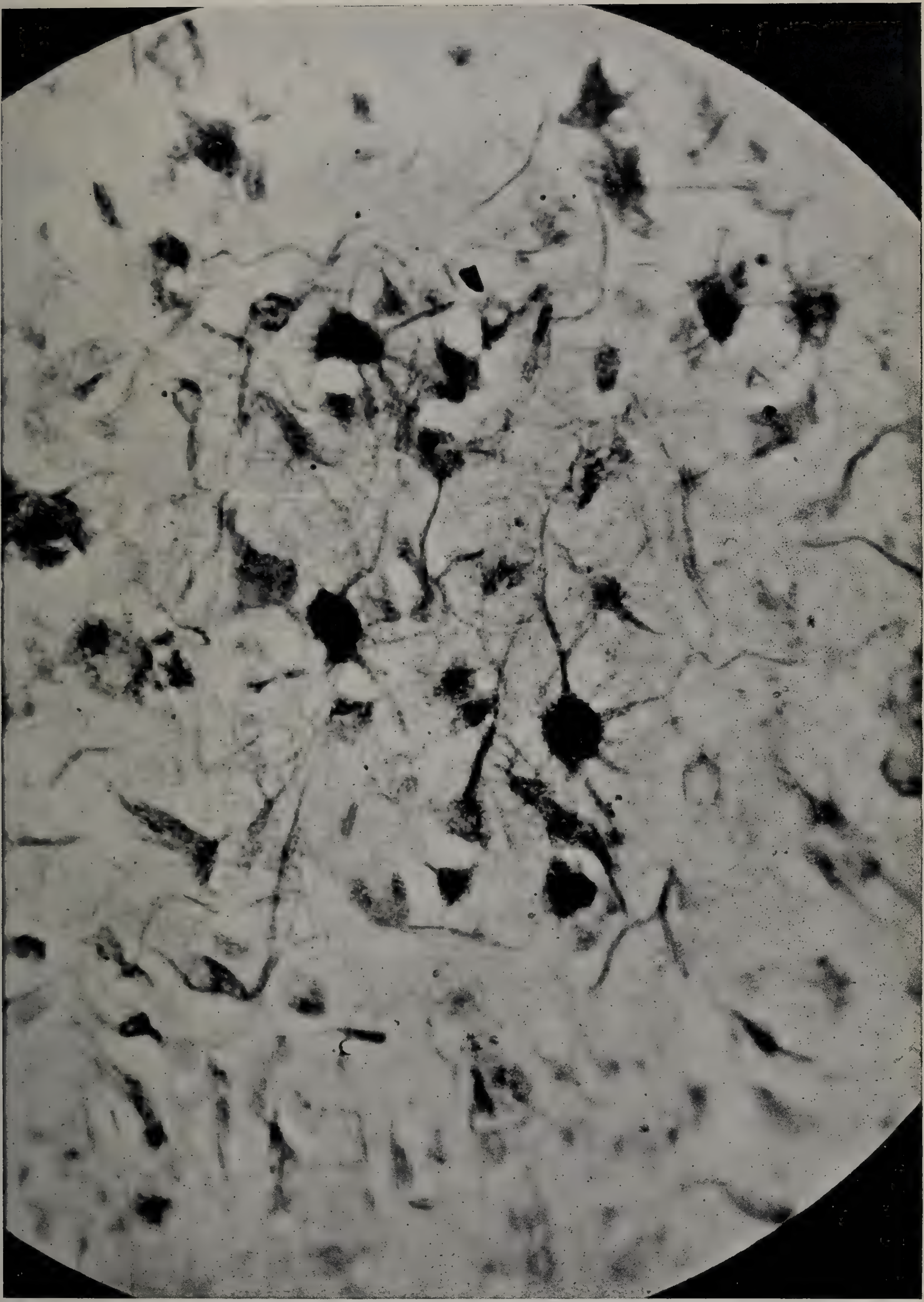


Fig. 5. — Microphotograph. Same region as Fig. 3. Zeiss objective 1/12, ocular 6.

PLATE VIII.

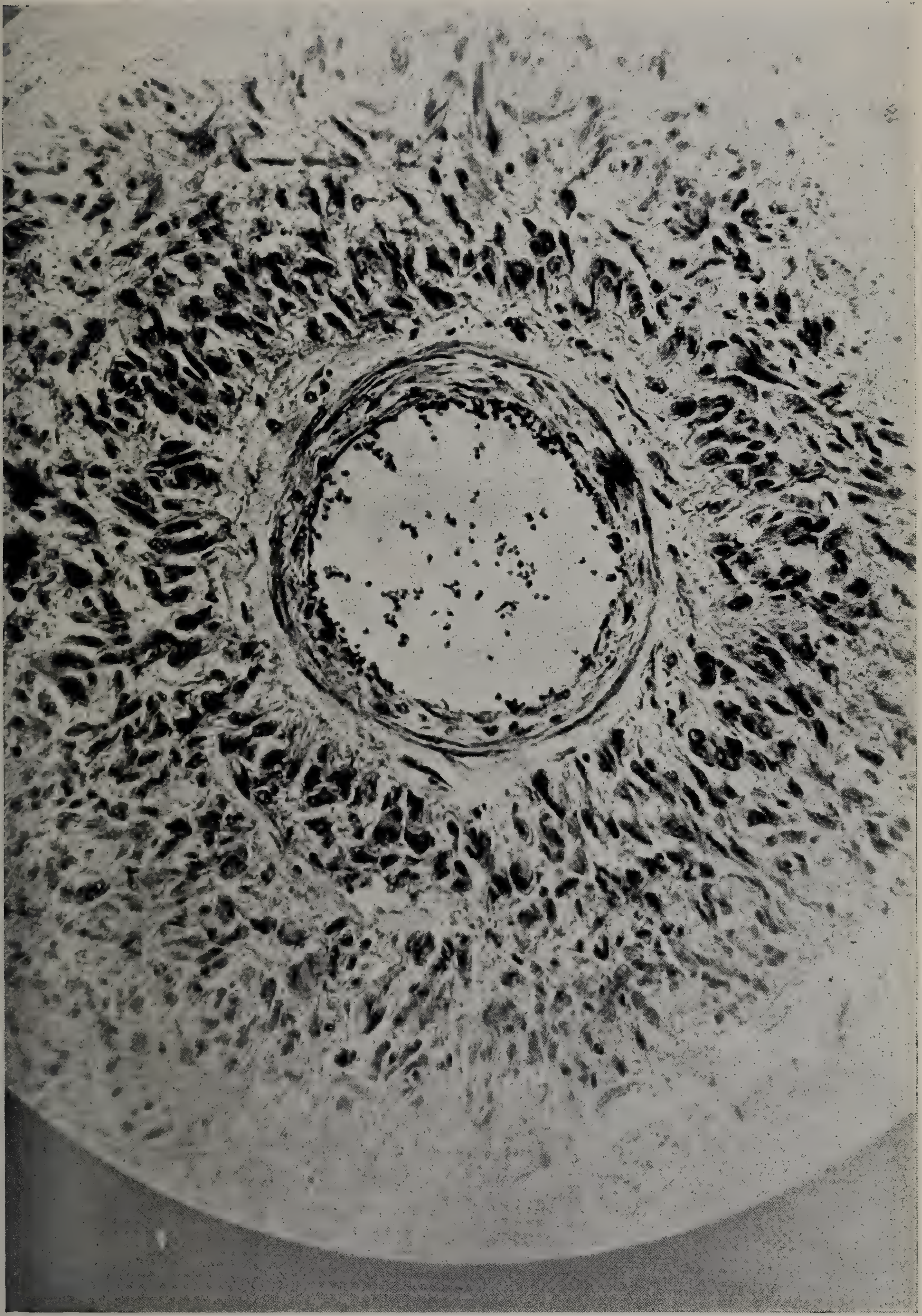


Fig. 6. — Microphotograph. Blood vessel from margin of tumor, showing cellular proliferation from area 3, Fig. 2. Zeiss objective *aa*, ocular 12.

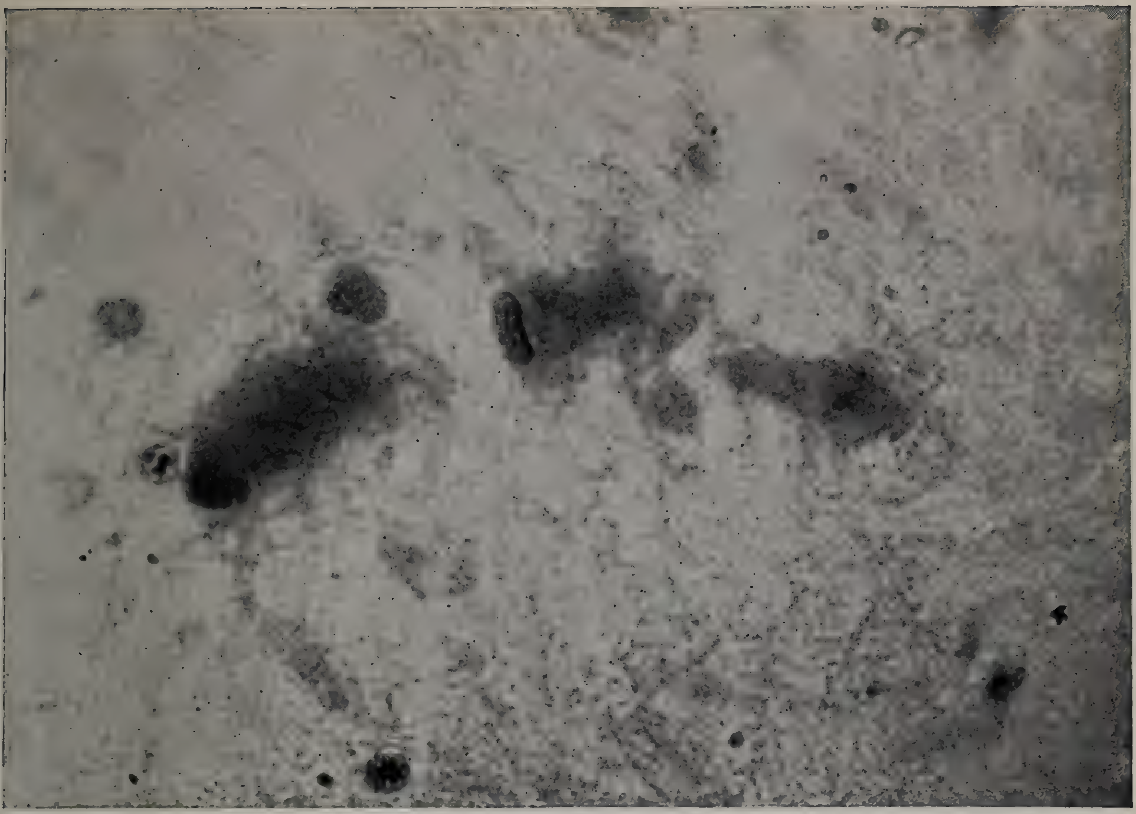


Fig. 7.

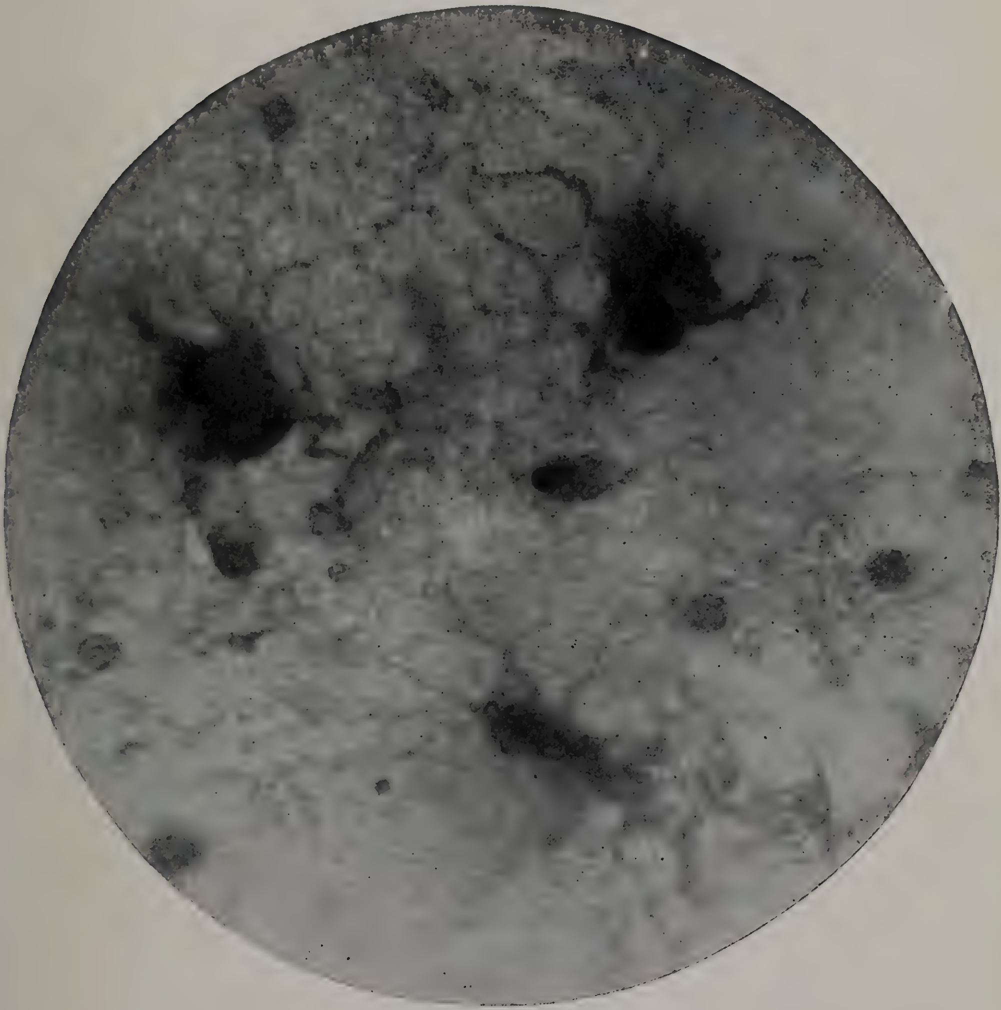


Fig. 8.

Figs. 7 and 8. — Microphotographs. Neuroglia cells from area 4, Fig. 1. Merzbacher Victoria-blue stain, objective, immersion 1/12, ocular 6.

PLATE X.

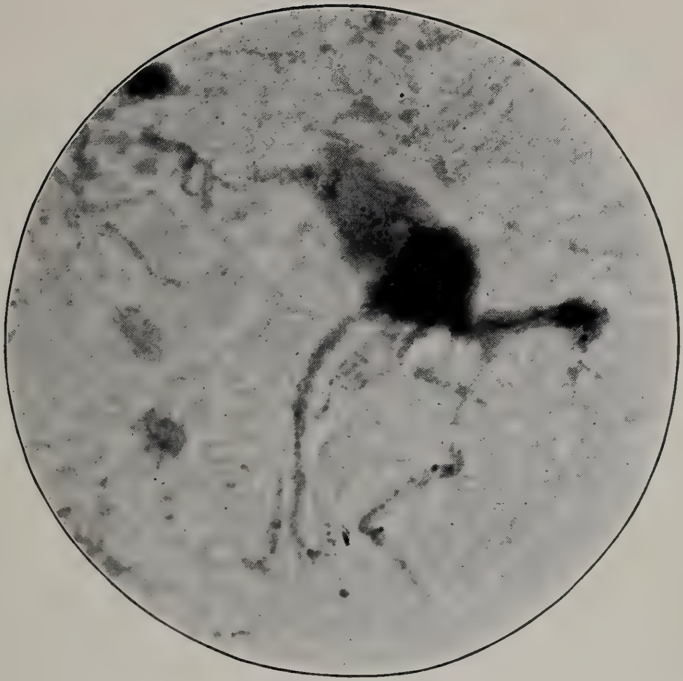


FIG. 9.

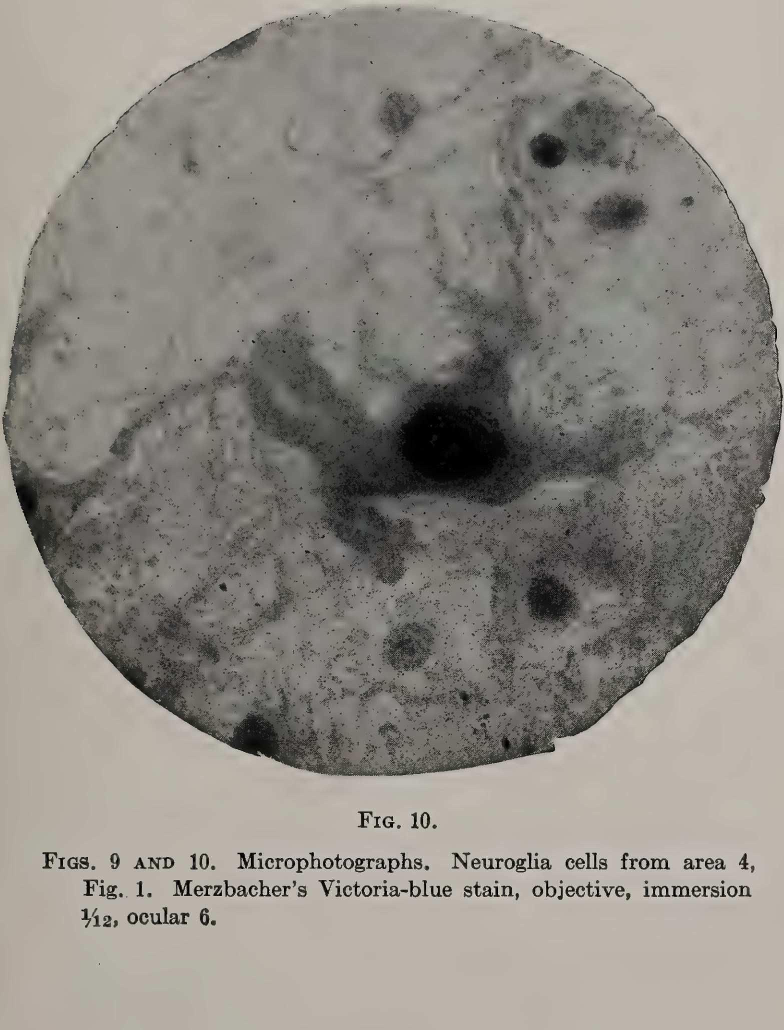


FIG. 10.

FIGS. 9 AND 10. Microphotographs. Neuroglia cells from area 4, Fig. 1. Merzbacher's Victoria-blue stain, objective, immersion $\frac{1}{12}$, ocular 6.

PLATE XI.

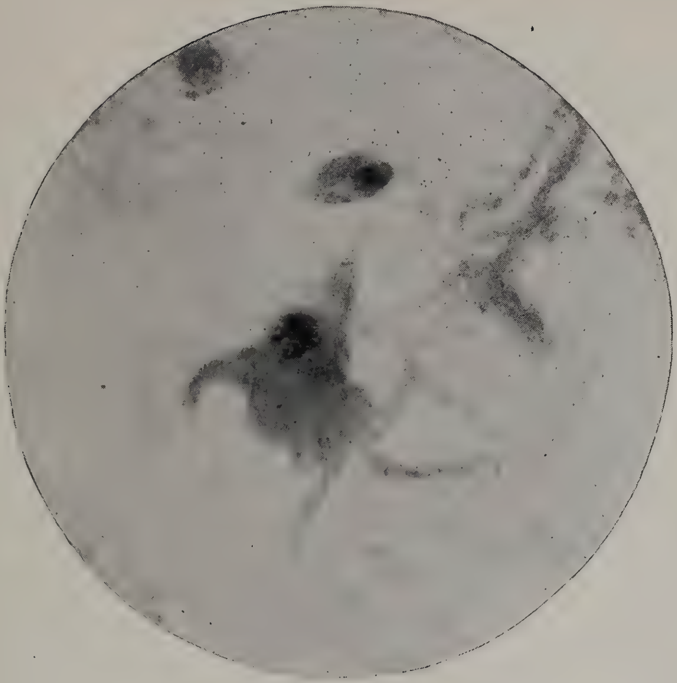


FIG. 11.

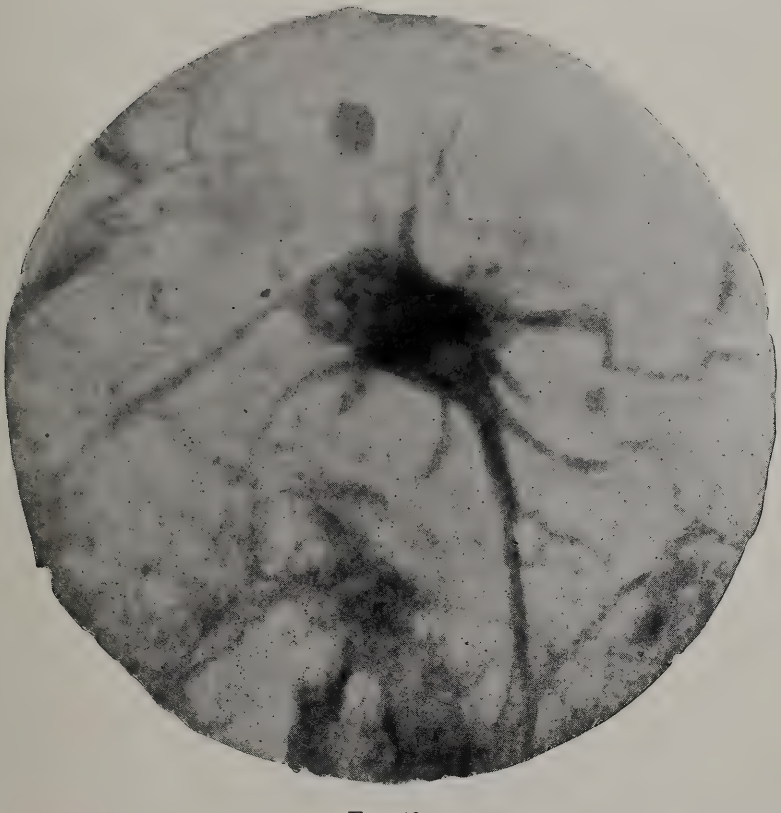


FIG. 12.

FIGS. 11 AND 12. — Microphotographs. Neuroglia cells from area 4, Fig. 1. Fig. 11. — Merzbacher Victoria-blue stain. Fig. 12. — Cajal's gold-sublimate method, Zeiss objective, immersion 1/12, ocular 6.

Naturally, no definite conclusions can be drawn from the study of only a few cases, and it is hoped that various comparative studies will give more information concerning the types of cells found in these cases, and eventually their function may be more definitely revealed.

In conclusion, the writer wishes to express his indebtedness to Dr. George A. Lierle of Burton, Ill., who had charge of the case and who furnished the history, and to Dr. Ralph T. Hinton, superintendent of the Peoria State Hospital, who sent the brain to the laboratory.

REFERENCE.

1. Merzbacher and Uyeda: "Das reactive Gliom und die reactive Gliose." Zeitschrift für die Gesamte Neurologie und Psychiatrie, Vol. 1, 1910, p. 285.

AN ANALYSIS OF FOURTEEN CASES OF SENILE DEMENTIA SHOWING NEITHER ATROPHIC NOR ARTERIOSCLEROTIC CEREBRAL CHANGES AT AUTOPSY.

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One of the conclusions drawn by Southard from an analysis of the senile material from the Danvers State Hospital was that the diagnosis of senile dementia is too freely used.[1] The diagnosis had been given, it appeared, on insufficient grounds in 14 of the 42 cases specially studied. It will be remembered that all 42 cases had been universally regarded as senile dements by the different diagnosticians at the Danvers daily clinics. To quote conclusion 2: —

> Fourteen cases which showed neither cerebral atrophy nor cortical arteriosclerosis (with obvious damage to the cortical tissues) are cases which probably should not have been termed senile dementia, and perhaps more properly belong in a group of senile acute psychoses or other mental diseases, occurring in old age, but not depending on recognizable senile changes.

Southard was able to find a fairly definite group of senile dementias accompanied by brain atrophy (8 in 42). Twenty other cases in the series either showed a complication of brain atrophy with arteriosclerotic cortical damage or else showed such arteriosclerotic injuries alone, so that Southard felt that the cases were either too complex for the study of morbid entities or were best explained as instances of organic dementia.

The 14 cases without either brain wasting or cortical injury from arteriosclerosis form a group especially worthy of study. The whole question has considerable bearing on the direction of therapeutics. As has been stated in Southard's report as pathologist to the Massachusetts Board of Insanity: —

> Many of these cases are just old persons with relatively intact nervous systems, who have almost the same chance of recovery as persons attacked earlier in life. This fact will secure greater therapeutic attention for certain cases hitherto dubbed "hopeless" dements.

And, again: —

> Though the majority of the insane of advanced age are hopelessly insane, an important minority has the same chance as have younger cases, shaded a trifle by the capacities of old age itself. It is this minority (perhaps 1 case in 3) which we must learn to differentiate properly in life.

It therefore became important to study more intensively this group of senile non-atrophic, non-arteriosclerotic cases to see what may be the special pitfalls of diagnosis. In this study first the clinical records were gone over carefully and the symptoms compared with the symptomatology of senile dementia as outlined by Kraepelin in his "Psychiatrie." When there was any doubt about the interpretation of the symptoms, or the period of observation was too brief to allow a decisive judgment, the case was excluded from the group for analysis, since here it was the intention to examine only cases of undoubted senile dementia. The positive cases were then analysed in detail with regard to the leading clinical symptoms, and the results compared with those obtained by Southard in his examination of cases of senile dementia, the brains of which were found post mortem to be either atrophic or arteriosclerotic. Then the gross and microscopical findings in the central nervous system were given detailed consideration in order to find whether any other constant changes occurred here that could explain the mental disturbance. And, finally, the autopsy findings in other parts of the body than the nervous system were considered, to determine if pathological changes existed here that would explain wholly or in part the mental symptoms. In this way it was hoped that some decision might be reached about what symptoms of senile dementia were due to atrophy and arteriosclerotic destruction and what were not. For the symptoms found in non-atrophic and non-arteriosclerotic brains, some explanation was sought in other changes in the nervous system and in pathological conditions in other parts of the body.

In going over the clinical and autopsy records of the 14 cases, 4 were excluded from the analysis, either because the diagnosis seemed incorrect or because the dementia present was too slight and the symptoms too ill-defined to be safely utilized in drawing conclusions. Case No. 965 showed little dementia and the absence of certain characteristic symptoms, such as restlessness at night, disorientation and delusions. The memory defect found clinically may have been due to the poor physical condition resulting from a cancer of the liver found at autopsy. Case No. 1070 gave a history of epilepsy, and during the short stay in the hospital was in a delirious condition closely simulating epileptic delirium in some respects. At least no positive diagnosis can be reached from the clinical data at hand. Case No. 1078 showed little dementia, since disorientation, memory defect, and impressibility defect were absent. The carcinoma of the intestines found post mortem may have been responsible for the so-called hypochondriacal ideas. Case No. 1271 was probably one of semile dementia, with little dementia, but as some important symptoms (disorientation, lack of insight, and marked memory defect) were absent, it was excluded.

The 10 cases remaining after the exclusion of these 4 seem in the clinical pictures to correspond fairly well with the symptoms of senile dementia as outlined in Kraepelin's "Psychiatrie." There follows a short abstract of the clinical, autopsy and microscopical findings in each case: —

Autopsy No. 865. — J. W., male, aged seventy-one. Admitted to Danvers State Hospital March, 1904. Died April, 1904.

Family History. — No insanity or intemperance in ancestry.

Personal History. — Common school education. Came to United States from Ireland at eighteen. Married at twenty-two. Worked as a laborer and farmer, and remained in one place for thirty years. Was industrious and married life was happy. Used tobacco freely and whisky moderately. No illnesses of note. For two years before entering hospital had complained of headache and sleeplessness. Became inactive and depressed. Steadily grew more feeble mentally and physically. Memory for recent events was impaired, but was good for remote happenings up to two weeks before admission. Since then has been slightly delirious: saw people breaking into the house; thought brother was responsible for his trouble; heard voices; mumbled to himself.

In Hospital. — Was feeble, restless and untidy. Conversation was irrelevant. Was completely disoriented; confused. No evidence of hallucinations. Memory was poor for recent and remote events. Was apprehensive, excitable and destructive. For four days before death remained in a comatose condition, taking only small quantities of liquid food. Picked feebly at the bed clothes.

Physical Examination on admission. — Poorly nourished; emaciated. Chest negative except for signs of a slight bronchitis. Pronounced arcus senilis. Arteries thick and tortuous. Pulse, 70 to 100; irregular. Temperature, 98.2. Right bubonocele. Albumin and a few hyaline casts in urine.

Neurological Examination. — Movements feeble and uncertain. Slight opacity of both lenses. Hearing impaired. Arm reflexes prompt. Both knee jerks exaggerated. Achilles and plantar reflexes normal. Pupils dilated, left larger than right; respond to light. Accommodation not determined. Sensation normal.

Diagnosis. — Senile dementia.

Autopsy by A. M. B. — Pedunculated tumor (nature(?)) of left arm. Chronic mitral endocarditis. Broncho-pneumonia of right lung. Acute laryngitis. Acute tracheitis. Pneumococcus infection of spleen (?). Slight chronic passive congestion of liver. Chronic interstitial nephritis. Cyst of kidney. Chronic external adhesive pachymeningitis. Slight chronic leptomeningitis. Arteriosclerosis of middle cerebral arteries. Brain weight, 1,370 grams.

Cause of death. — Broncho-pneumonia.

Microscopical Findings in the Central Nervous System. — The nerve cells contain a slightly increased amount of pigment. The neuroglia is pigmented especially in the gray matter, and the nuclei are increased in the subpial region. A moderate number of satellite cells surround the larger nerve cells. The cortical blood vessels are not thickened but a large amount of pigment is found in the vessel walls. Cord not examined.

AUTOPSY No. 919. — J. G., male, aged seventy-nine. Admitted to Danvers State Hospital Oct. 25, 1904. Died Oct. 30, 1904.

Family History. — Negative.

Personal History. — Common school education. Quiet, retiring disposition. Worked on farm until four years before admission. Lame from rheumatism for eight years. Did not use alcohol or tobacco. Began to show signs of failure four years before admission. In August, 1904, became delirious after taking some patent medicine, but quickly recovered. Could not remember what had happened, however. Memory has been failing for two years. A week before coming to the hospital, became suddenly incoherent, delirious and restless. Did not recognize relatives, or know where he was.

In Hospital. — Was delirious, completely disorientated and confused; untidy. Remained in bed; two days after admission became comatose and died three days later.

Physical Examination on Admission. — Well developed and nourished. Gangrene of right foot. Temperature, 99.4. Dullness over both lower backs. Arcus senilis. Arteries thick. Heart enlarged, irregular and intermittent. Pulse, 108. The neurological findings were: movements feeble and incoördinate. Unable to stand. Hearing and vision about normal. Pupils equal; reaction not determined. Tendon reflexes present in arms. Left knee jerk diminished and right absent. Achilles reflexes absent on both sides. Plantar reflex is normal on the left, absent on the right. Sensation about normal.

Diagnosis. — Senile dementia.

Autopsy One Hour Post Mortem. — Gangrene of right foot and lower leg. Arteriosclerosis and partial thrombosis of right anterior and posterior tibial arteries. Arteriosclerosis of aorta and of coronary and iliac arteries. Chronic interstitial nephritis. Chronic fibrous pleuritis. Chronic splenitis. Sacral decubitus. Obesity. Chronic external adherent pachymeningitis. Slight chronic leptomeningitis. Slight atrophy of frontal convolutions.

Microscopical Examination of the Nervous System. — Shows nothing beyond the usual changes of senility. A slight degeneration of the columns of Gall and Burdach is found in Weigert preparations of the cord.

AUTOPSY NO. 927. — M. B., female, aged seventy-two. Admitted to Danvers State Hospital Nov. 9, 1904. Died Nov. 20, 1904.

Family History. — Mother died of tuberculosis. One uncle insane.

Personal History. — Early history unknown. Married at twenty-five, and spent ten years on the sea. Was always well. Three years ago memory began to fail; began to lose her way in familiar streets, and since then there has been a gradual failure more rapid in the last year. Within last year became restless at night. Had hallucinations of hearing. Sometimes is sad and cries, and at other times is very happy. Apprehensive at times. Restless. Constantly repeats phrases such as "Come, let's go home. They won't know where we are." At times does not recognize members of her own family. No history of alcohol or drugs.

In Hospital. — Was very resistive and stubborn. Restless and confused. Talked incoherently. Attention very poor. Disorientated. Jabbered much of the time. Untidy. Took nourishment poorly. Often restless at night. Remained in about the same condition for a week, and then developed a temperature of 100. Died of pneumonia a few days later.

Physical Examination on Admission. — Fairly well nourished. Ecchymosis of skin of face. Systolic murmur transmitted along sternum. Œdema of legs. Arteries not thickened. Urine shows trace of albumin and a few hyaline casts. Gait feeble. Tremor of lips and body. Hearing and vision normal. Knee and plantar reflexes normal. Pupils equal, central, regular, react sluggishly to light. Resisted examination.

Diagnosis. — Senile dementia.

Autopsy by A. M. B. — Submaxillary tumor (nature not determined). Broncho-pneumonia (hyperplastic). Chronic fibrous pleuritis. General arteriosclerosis. Acute splenitis. Chronic diffuse nephritis. Subpial œdema. Considerable atrophy of first and second frontal convolutions of both sides. Anomaly of basal vessels. Brain weight, 1,240 grams.

Cause of Death. — Broncho-pneumonia.

Microscopial Findings in the Central Nervous System. — In the frontal regions the nerve cells seem to be more sparse than usual, and the glial cells are increased in numbers. Elsewhere the pyramidal cells are normal. In both gray and white matter scattered spider cells are found, and in the superficial stratum the number of glial cells are increased. In the gray matter the neuroglia is pigmented. Pigment is found in the vessel walls in rather large amounts. Cord not examined.

AUTOPSY NO. 998. — E. C., female, aged seventy-three. Admitted to Danvers State Hospital Aug. 31, 1904. Died Aug. 29, 1905.

History. — Not obtained. Transferred from Lawrence almshouse. In almshouse, said they tried to kill her. Speech was incoherent. Communed with angels at night. Was stubborn. At times was bright and happy.

In Hospital. — Was happy and garrulous, talking in a loud voice. Was difficult to examine because of deafness. Said she had been in the hospital six or seven years, and apparently had no idea of place or persons. School knowledge was very deficient. Hallucinations were probably present, but their nature could not be ascertained. Talked of guardian angels around her. Memory could not be tested, but she dwelt on events of early life, thus suggesting a defect for recent events. Had delusions of persecution. Said some people wanted to kill her and steal her clothes, but that they would be damned by the guardian angel which protects her. Had no insight. Was contented and jolly. Talked much in a rambling manner. Was tidy. After a few months became very feeble and was kept in bed. Here was usually quiet until some one approached her, when she would talk volubly. Was observant of things about her on the ward. Slept well. Could recognize doctors and nurses as such. Her temperature rose to 103, and she gradually failed, dying two weeks later.

Physical Examination on Admission. — Very feeble, and hardly able to stand. Poorly developed and nourished. Varicose veins and scars of old varicose ulcers on legs. Arcus senilis. Teeth absent. Lungs emphysematous. Systolic murmur at apex. Pulse very irregular. Arteries hard and tortuous. Abdomen distended and liver dullness decreased. Neurologically, vision was fair; hearing totally gone. Pupils not tested for reaction, but were equal. Arm reflexes normal. Knee jerks diminished (due to poor relaxation). Gait very feeble.

Diagnosis. — Senile dementia.

Autopsy Seven Hours Post Mortem by A. M. B. — Emaciation. Decubitus. Chronic fibrous pleuritis. Chronic fibrous pericarditis (milk patch). Chronic fibrous myocarditis. Chronic fibrous endocarditis, mitral, aortic, mural. Œdema and hypostasis of right lung. Broncho-pneumonia and bronchiectasis (local) of left lung. Marked general arteriosclerosis with calcification. Acute splenitis. Congestion of liver. Retroversion of uterus. Chronic external adhesive pachymeningitis. Some narrowing of convolutions, frontal, parietal. Consistency of brain decreased. Severe athroma of larger basal vessels. Brain weight, 1,135 grams.

Cause of Death. — Broncho-pneumonia.

Microscopical Findings in the Central Nervous System. — The pyramidal cells are slightly decreased in the frontal region but elsewhere show no abnormal changes. Pigment occurs in the nerve cells in large amounts. The Betz cells are normal. The neuroglia is normal except for a slight pigmentation in the gray matter. The cerebellum is normal. The smaller blood vessels are not sclerosed but contain pigment in their walls. Cord not examined.

Autopsy No. 1153. — W. G., male, aged eighty-three. Admitted to Danvers State Hospital January, 1907. Died March, 1907.

Family History. — Negative (not definite).

Personal History. — Common school education. Was first in express business, and later in small candy and cigar store. For last seventeen years before admission did not work (had leg amputated at that time). Once had typhoid. Before operation was a periodic drinker (eight to twelve months), but has not used liquor since. Onset of mental trouble two years before admission, when he began to wander from home and get lost. Before this for two or three years a failure in memory was noticed. Became restless at night and threatening to family. Had delusions of persecution, and was often noisy and excited. Could not remember his own name.

In Hospital. —Was restless and talked loudly. Difficult to examine because of deafness. Was confused and completely disorientated. Answers were not relevant. Hallucinations were present, but their nature could not be definitely ascertained. Memory was probably disturbed for both remote and recent events. Probably had delusions. No insight. Irritable and apprehensive. In bed all the time. Untidy. About a week after admission became stuporous coincident with the appearance of erysipelas on face, and died in this condition.

Physical Examination on Admission. — Fairly well developed but poorly nourished. Arcus senilis. Heart enlarged to left; no murmurs. Arteries hard and tortuous. Pulse, 92. Gait was feeble and unsteady. Could not stand in Romberg position. Coarse tremor of hands and tongue. Pupils were regular. Left was pinpoint in size. Both react to light. Knee jerks were normal. Achilles and plantar reflexes could not be obtained.

Diagnosis. — Senile dementia.

Autopsy Forty-six Hours Post Mortem by E. E. S. — Hypostatic pneumonia. Acute splenitis. General arteriosclerosis with calcification. Brown atrophy of heart. Slight sclerosis of all heart valves. Chronic fibrous ventricular endocarditis. Chronic splenitis. Chronic appendicular perityphlitis. Chronic atrophic gastritis. Slight hydronephrosis on both sides. Fatty changes of kidneys. Slight pigmentation of the pyramids of the kidneys. Chronic external adhesive pachymeningitis (left hemisphere). Œdema of brain (*post mortem,* inhibition). Palpable sclerosis of frontal poles, superior frontal gyri, and superior temporal gyri. Atrophy of anterior extremities of both superior temporal gyri. Basal vessels sclerotic. Brain weight, 1,425 grams.

Causes of Death. — Pneumonia; erysipelas.

Microscopical Findings in the Central Nervous System. — Pyramidal cells seem to be decreased in the supra-stellate layers in the frontal and temporal areas and more so on the left side than on the right. In other regions cells appear normal except for an increase of pigment. Neuroglia normal. A moderate number of satellite cells surround the larger nerve cells. In focal areas pigment is found free in the gray matter. The cortical blood vessels are considerably thickened in places, but no occluded vessels are found. The adventitia contains large amounts of pigment. Sections of the cord stained by Weigert's myelin sheath method show a slight posterior column degeneration. Marchi preparations of the cord show nothing.

Autopsy No. 1197. — Female, aged eighty-one. Admitted to Danvers State Hospital December, 1906. Died September, 1907.

History. — Not obtained of past life. Admitted from almshouse. Physician's certificate says: "Onset gradual several years ago. Temperate. Speech incoherent and inarticulate. Screeches constantly. Destructive. Restless. Violent."

In Hospital. — Usually good natured, but sometimes cross and violent. Very restless. Talked in a loud voice. Completely disorientated. Thought she was in Ireland. Probably no delusions or hallucinations. Marked memory defect for recent events. Could not remember physician from one visit to another. Talked constantly of events of early life. Conversation rambled. Continued in about the same condition until July, 1907, when she broke two ribs. Later became stuporous and confused, and soon died.

Physical Examination on Admission. — Knee joints enlarged. Temperature, 99. Heart enlarged. Arteries knotty. Pulse slow and regular. Urine negative. Unable to stand or walk steadily because of feebleness and enlargement of knee joints. Movements are uncertain. Extremely deaf in both ears. Vision dim especially in right eye. Knee jerks absent (due to swelling in knees). Achilles reflexes not obtained because of patient's inability to relax. Plantar reflexes normal. Arm reflexes are sluggish. Right pupil does not react to light and left only slightly.

Diagnosis. — Senile dementia.

Autopsy Twelve Hours Post Mortem by R. and A. — Marked emaciation. Contractures of knees. Broncho-pneumonia, right. Chronic mitral endocarditis. Chronic adhesive pleuritis, left. General arteriosclerosis. Phlebosclerosis. Chronic perisplenitis. Chronic interstitial nephritis. Chronic passive congestion and cirrhosis of the liver (slight). Small cyst of left ovary. Chronic external adhesive pachymeningitis (slight; frontal). Chronic leptomeningitis and subpial œdema, frontal. Slight granular ependymitis, lateral. Basal and pial vessels thickened. Brain weight, 1,190 grams.

Cause of Death. — Broncho-pneumonia.

Microscopical Examination of the Central Nervous System. — Nerve cells seem to be slightly decreased in the precentral regions and are markedly decreased in the right temporal gyri. The only change in the neuroglia is a slight pigmentation in the gray matter. In places the blood vessels are somewhat sclerosed, and the walls are pigmented. There is a prominent posterior column degeneration in the cord. The blood vessels of the cord are thickened.

Autopsy No. 1239. — S. W., female, aged seventy-nine. Admitted to Danvers State Hospital June, 1904. Died March, 1908.

History. — Not obtained. Physician's certificate says: "Violent. Incoherent. Sometimes stuporous. Sometimes wanders away. Does not sleep well."

In Hospital. — Was excited, apprehensive and noisy. Somewhat resistive. Soon became more quiet. Could not find her room on the ward. Muttered unintelligibly to herself. Gave incoherent answers to questions. Often cried. Had a good appetite and slept well. Was completely disorientated. Memory was poor for remote and recent events. Could not repeat the alphabet. No hallucinations or delusions. Was irritable. Later became untidy. Mental condition remained about the same until her death.

Physical Examination on Admission. — Well developed and nourished. Facial hirsuties. Anæmic. Arcus senilis. Pupils normal. Vision probably somewhat impaired. Hearing markedly impaired in both ears. Knee jerks diminished; plantar reflexes normal. Achilles reflexes absent. Tendon reflexes normal in arms. A general weakness of the muscles with some atrophy was present. Speech thick and indistinct. Gait feeble. Sensation not tested. Heart negative. Vessels thickened. Pulse, 72; regular. Urine negative.

Diagnosis. — Senile dementia.

Autopsy Seventeen Hours Post Mortem by R. and C. — Obese and anæmic. Œdema of legs. Acute splenitis. Pyelonephritis, left. Chronic fibrous pericarditis. Hypertrophy of heart and brown atrophy of heart muscle. Pulmonic endocarditis and aortic vegetative endocarditis. Chronic adhesive pleuritis and emphysema of lungs. Aortic sclerosis with calcification. Cysts and small tumors of left kidney. Chronic gastritis with dilatation of stomach. Calcified nodule in bladder wall. Fatty liver. Nodule in liver. Erosion of cervix. Chronic external adhesive pachymeningitis (general) with calcification. Chronic fibrous diffuse leptomeningitis, sulcal. Slight basal arteriosclerosis. Slight parietal atrophy, both sides. General cerebral gliosis especially frontal and occipital. Brain weight, 1,145 grams.

Cause of Death. — Heart failure.

Microscopical Examination of the Nervous System. — No degenerative changes occur in the nerve cells. The neuroglia shows proliferative changes everywhere, and there is an increase in the cells in the gray matter. There are a moderate number of satellite cells. Blood vessels are not unusual. The posterior columns of the cord show a slight degeneration by the Weigert method. The anterior horn cells contain very large amounts of pigment.

Autopsy No. 1263. — S. O., female, aged seventy-five. Admitted to Danvers State Hospital May, 1906. Died August, 1908.

Family History. — Not obtained.

Personal History. — Education poor. Habits good. Disposition willful and proud. Health always good until onset of mental trouble four years before admission. First a memory defect and irritability appeared.

Became restless and unreasonable. Had fleeting auditory and visual hallucinations. Became apprehensive and thought some one was around the house at night trying to enter. Got the idea that certain neighbors owed her money and demanded it from them. Always temperate.

In Hospital. — Was quiet and satisfied but apprehensive. Was completely disorientated. No hallucinations. Memory defective for recent and fair for remote occurrences. Statements were disconnected. At times suspicious of those about her. No delusions. Generally pleasant but easily irritated. Impressibility very poor. Some insight. Tidy. No important changes in her condition occurred.

Physical Examination on Admission. — Well developed and nourished. Arcus senilis. Systolic murmur at apex of heart. Arteries thickened. Stands in Romberg with slight swaying. Gait normal. Vision fairly good. Hearing good. Knee and Achilles jerks normal. Plantar flexion of toes is present. Arm reflexes normal. Pupils react to light and in accommodation. Sensation normal.

Diagnosis. — Senile dementia.

Autopsy Eleven Hours Post Mortem by S. and R. — Chronic fibrous myocarditis. Chronic fibrous mitral, tricuspid and aortic endocarditis. Œdema and congestion of lungs. General arteriosclerosis. Acute congestion of liver and spleen. Chronic interstitial nephritis. Hemorrhagic pancreatitis. Fibro-myomata (?) of stomach. Diverticulæ of intestines. Cystitis. Chronic external adhesive pachymeningitis. Chronic sulcal leptomeningitis. Frontal and prefrontal atrophy. Gliosis of superior and middle frontal, occipital and occipito-temporal regions; also of hippocampal gyri. Brain weight, 1,325 grams.

Cause of Death. — Pneumonia (?).

Microscopical Examination of the Brain and Cord. — Pyramidal cells are not unusual. Cellular pigment is slightly increased. Spider cells are scattered through the gray matter and there is a slight cellular gliosis in the most superficial layer. In the hippocampal region there is a marked gliosis of the suprastellate layers of gray matter with the formation of hyaline bodies. The walls of the larger vessels contain pigment. In the posterior columns there is a slight degeneration which is more marked on one side. The pia of the cord is thickened and there is a subpial gliosis.

AUTOPSY NO. 1275. — B. C., male, aged seventy-three. Admitted to Danvers State Hospital June, 1908. Died September, 1908.

Family History. — One cousin insane for a short time but recovered. No epilepsy or intemperance in family.

Personal History. — Grammar school education. Did not become interested in studies. Odd and stubborn. Not successful in business. Changed occupations often. Drank moderately but could not stand much liquor. Four months before admission memory began to fail. Excited and cross at times. Uncleanly.

In Hospital. — Generally quiet though restless at times. Spoke little but answers were relevant. Disorientated for time and place. School knowledge very poor. Writing showed some tremor. Attention poor. Memory poor for recent events and impaired for remote occurrences. No hallucinations present. No delusions. Impressibility poor. No insight. Untidy at times.

Physical Examination on Admission. — Fairly well nourished. Heart enlarged, with diastolic murmur over aortic area. Pulse regular but weak. Arteries tortuous. Urine shows trace of albumin and many hyaline casts. Gait is very feeble. Extremely deaf but could usually be made to understand. Vision good. Pupils equal, regular and small. React slightly to light and in accommodation. Tendon reflexes lively. All superficial reflexes absent. Sensation about normal.

Diagnosis. — Senile dementia.

Autopsy Three Hours Post Mortem by E. E. S. — Scalp wound, and various abrasions on other parts of the body. Slight icterus. Erysipelas of scalp. Fracture of left third costal cartilage with suppuration extending into superior mediastinum and communicating with left pleural cavity. Acute fibrinous pleuritis, left. Hypertrophy of heart and chronic fibrinous myocarditis. Hydropericardium. Chronic mitral and aortic endocarditis with small vegetations. General arteriosclerosis with calcification. Diffuse aneurysm of both iliac arteries. Small hemorrhages of the spleen. Chronic interstitial (arteriosclerotic) nephritis. Cholelithiasis and chronic cholecystitis. Adhesions around gall bladder. Chronic external adhesive pachymeningitis, orbital. Chronic leptomeningitis of base and along vessels of convexity. Narrowing and gliosis of both frontal lobes, and of both superior temperal lobes, anteriorly. Brain weight, 1,285 grams.

Cause of Death. — Erysipelas.

Microscopical Findings in the Central Nervous System.—Pyramidal cells not unusual. There is a subpial gliosis and in places small groups of neuroglia cells are found just beneath the pia. Spider cells occur both in the gray and the white matter. The blood vessels are not thickened but contain pigment. In the superficial cortical layers there is a slight perivascular gliosis. The only change in the cord is a slight bilateral pyramidal tract degeneration.

Autopsy No. 1288. — A. M., female, aged eighty-six. Admitted to Danvers State Hospital October, 1908. Died November, 1908.

Family History. — Both maternal grandfather and grandmother had senile dementia. Negative on father's side. Mother demented in old age. Two sisters aged eighty-five and eighty-nine, respectively, show signs of senile dementia. No alcoholism or epilepsy in ancestry.

Personal History. — Common school education. Married at twenty-six; married life happy. Always distant and rather stubborn. Worried over trifles. Had pneumonia three times during last eighteen years. No trouble at the time of the climacteric. Always strong mentally and physically until four years before admission, when following an attack of bronchitis patient began to fail. Before this had been very religious, but now lost all interest in religion. Memory began to fail. Two years later nocturnal restlessness developed. Became irritable and threatening. Delusions of persecution developed, and later auditory and visual hallucinations. Later did not know where she was, and did not recognize her own son and daughter. Speech became disconnected. Speech was thick during whole time of illness. Had no shock.

In Hospital. — Restless day and night. Memory very poor. Impressibility very poor. Attention poor. Completely disorientated. Some insight. Appetite poor. Untidy at times. Resistive at times. Irritable. No hallucinations or delusions. Articulation poor. After pneumonia developed was unconscious four days before death.

Physical Examination on Admission. — Poorly nourished. Arcus senilis. Œdema of legs. Respiration, 26. Heart intermits occasionally. Pulse, 70; of high tension. Arteries tortuous. Urine contains albumin, erythrocytes and hyaline casts. Too feeble to walk unassisted. Tendon reflexes diminished. No Babinski. Achilles reflexes absent. Pupils are regular, but do not react either to light or in accommodation. Vision and hearing fairly good. Sensation normal except over the œdematous area.

Diagnosis. — Senile dementia.

Autopsy Thirty-nine Hours Post Mortem by P. and C. — Emaciation. Œdema of arms and legs. Arcus senilis. Lobar pneumonia. Acute and chronic obliterative pleuritis of both sides. Calcified nodule (tuberculous (?)) in one apex. Hypertrophy of heart. Chronic fibrous, mural and valvular endocarditis. General arteriosclerosis with ulceration and calcification. Chronic fibrous peritonitis with ascites. Chronic perisplenitis. Chronic interstitial nephritis. Chronic hepatitis and perihepatitis. Cholelithiasis and atrophy of cystic duct. Chronic interstitial pancreatitis. Chronic cystitis. Chronic external adhesive pachymeningitis. Slight chronic leptomeningitis along vessels. Marked subpial œdema. Encephalomalacia (?). Marked convolutional atrophy, frontal and parietal. Basal vessels moderately sclerosed. Brain weight, 1,260 grams.

Cause of Death. — Lobar pneumonia.

Microscopical Findings in the Nervous System. — Sections of the brain show nothing. Weigert preparations of the cord show a slight degeneration of the tract of Goll in the cervical region.

A comparison of the course and symptoms of the psychoses in the above cases with the clinical manifestations of those cases that were found to have brains showing definite arteriosclerotic or senile atrophic changes does not disclose any very striking differences. This fact is true both when the clinical picture as a whole is considered, and when the percentages of the occurrence of the chief facts in the history and clinical study are compared in parallel columns. It is true that in some of the cases the histories were very incomplete and the period of observation in the hospital brief, and that had a more thorough study been possible, a different conclusion might have been reached; but taken by and large it does not seem wise to question the diagnoses of the clinicians.

As far as the final outlook in the cases of this group is concerned, there would seem to be little practical value in attempting to differentiate between a manic-depression or other functional state and the organic conditions. The age of the patients at the time of admission to the hospital (seventy-one to eighty-six years, average seventy-seven years) or at the onset of the psychosis (sixty-eight to eighty-two years, average seventy-four years), the poor physical condition in most of them, and the advanced cardiovascular-renal lesions found in each almost preclude a favorable prognosis, whatever the psychosis. This conclusion is further supported by the fact that in the 2 cases that remained in the hospital a year or longer, no improvement in the mental symptoms was noted.

In attempting to find an anatomical basis for the mental condition, it is not necessary to seek far either with regard to the body as a whole or in the central nervous system. A consideration of the gross and microscopical findings in the viscera and central nervous system as well as the findings of the physical examination lead one to the conclusion that rather than being purely functional these psychoses have an organic basis doubtless modified and accentuated by disturbances of nutrition and by intoxication. In a majority of the cases a high grade of malnutrition and of muscular enfeeblement was present at the time of the first examination; and the low general resistance is evidenced by the number of deaths that resulted from septic processes. In all the cases there were more or less marked evidences of disease of the cardiovascular-renal system, both in life and at autopsy. This last finding assumes great importance in view of the recent work of Southard[2] on the role of Bright's disease in the production of certain types of delusions, and of that of Southard and Canavan[3] on the incidence of renal disease in the insane. These authors and others have found that the fact that mental disturbances do not occur in all cases of Bright's disease does not invalidate the argument that Bright's disease has a close connection with the psychosis in certain cases, — cases, perhaps, with naturally unstable nervous system. The impression of the mental attainments of the individuals in this series as obtained from the histories is not that their nervous systems were particularly stable or resistant to noxious agents.

None apparently ever occupied a position of any importance in the community in which he resided, and none ever enjoyed any measure of prosperity. The men were farm laborers or keepers of small shops. Two of the women entered the hospital from almshouses and two others had bad family histories. In three instances peculiarities of disposition were sufficiently marked to be noticeable to acquaintances. In all cases in which it is mentioned in the histories the education was that obtainable in grade schools. Apparently in this series, then, whatever toxic or nutritional disturbances might result from cardiorenal disease were acting on nervous systems inherently weak.

In addition to the somatic lesions, other factors that may have played some part in producing psychoses were defects of hearing, present in 6 instances, and a moderate use of alcohol, recorded in the histories of 3 cases.

Although no typical arteriosclerotic or senile atrophic changes were found in these brains, it is not necessary to conclude that the mental changes were the result purely or even chiefly of a disturbance of function through nutritional or toxic influences. Rather must one conclude after a study of the findings in the nervous systems that in most of the brains organic changes, — of a rather indefinite character perhaps, but nevertheless organic, — certainly were present. In 7 brains either increase in consistency or convolutional atrophy, or both, were noted in the macroscopical examination. In 6 cases there was noted a chronic leptomeningitis. In each of the 7 cases in which the cord was obtainable for study were found evidences of chronic degeneration corresponding fairly well to the position of the various fiber systems. This last finding seems especially worthy of emphasis. Although not necessarily indicating brain disease, the cord findings nevertheless give one the impression that such disease is probably present though in a form not demonstrable by the methods used. The arrangement of fibers in definite systems and the length of individual fibers are characteristics of the spinal cord that render comparatively slight degenerations easy to distinguish, whereas in the brain a similar change would not be evident owing to the intermixing of fibers of different lengths and subserving different functions. It requires no great effort of the imagination to connect the brain with the pyramidal tract degeneration found in 1 case, but the coexistence of brain changes with the posterior column degeneration found in 6 cases is less evident. Posterior column degeneration, however, is not rare in the aged (Hirsh[4] and others), and has been found in other pure brain lesions, as, for instance, tumors.[5] Since another explanation of the degeneration is found in only 2 cases (arteriosclerosis, meningitis), one must assume general causes; and general causes that affect the cord are quite as likely to affect the brain also.

With reservations in view of the limited number of cases studied and of unavoidable shortcomings in the histories and clinical notes in some of the cases, the following tentative conclusions seem justifiable: —

1. With the information at hand it does not seem justifiable to question the clinical diagnosis in any one of these 10 cases of senile dementia.

2. Even with a diagnosis of manic-depressive psychosis or of some other functional condition, the age and general condition of the patients would preclude a good prognosis.

3. In view of the recent studies of Southard and others the cardiorenal lesions found in all the cases assume great importance in a consideration of the etiology of the psychoses, — in the present series particularly since they coexisted with brains that one might assume to be congenitally weak.

4. Although there were no conclusive arteriosclerotic or atrophic alterations in the brains, the system degenerations found in the cords support the assumption that brain changes were present though of such a nature as not to be demonstrable by the methods used.

The material for this work was obtained from, and most of the work was done in, the laboratory of the Danvers State Hospital.

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PROGNOSIS IN PULMONARY TUBERCULOSIS.

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In pulmonary tuberculosis, early diagnosis and prompt and aggressive treatment are the most successful means of insuring a favorable prognosis. The physician, however, should consider many other factors in estimating the prognosis in any given case.

In making a study of a large number of patients with tuberculosis, we can generally tell what the prognosis will be in the great majority of these patients; but when it comes to the individual case, there is considerable difficulty in making our estimate of the result. Incipient cases of pulmonary tuberculosis sometimes progress rapidly to a fatal termination; and far advanced cases will frequently improve rapidly and live for years.

Is there any guide for us to use in picking out patients who belong to either of these two classes? There is no certain and definite way to decide this question, but much foreknowledge can be gained by a careful study of the following points: (*a*) heredity; (*b*) age; (*c*) past history and habits; (*d*) finances; (*e*) general physical and mental makeup of the patient; (*f*) temperature, pulse, cough and weight; (*g*) the rapidity of the advance of the disease; (*h*) the virulence of the invading bacteria, bacteriological and chemical study of the case.

Heredity. — Tuberculosis is rarely transmitted from mother to child, but a mother weakened from disease would naturally give birth to a child with a weakened constitution. There is also another factor to be considered where the mother is an active open case of tuberculosis. The chance that the child may become infected is very great even where the most rigid hygienic precautions are used. From 60 to 90 per cent. of children become infected with the tubercle bacillus by the time the fourteenth year is reached, and children in a household where there is an open case of tuberculosis are especially liable to become infected. These children do not all develop tuberculous disease; but, having become infected, they are constantly menaced by this infection which may become active at any time.

The age of the patient is important. The greatest number of deaths occur in early adult life. The case developing in middle life seems to have greater resistance to tuberculous infection.

Past History and Habits. — In taking the history of a patient with tuberculosis, we should note the habits in regard to alcohol, drugs, etc., and also take into account the working and living environment. When a person develops tuberculosis under poor hygienic conditions, the marked stimulation of the change from their surroundings to the sanatorium is great and their improvement is often very rapid; but in patients who develop tuberculosis under the best hygienic conditions, the prognosis is not so good, for they have developed the disease under good conditions and there is little if any stimulation in the sanatorium life for them.

Finances. — It requires time to secure an arrest of a tuberculous process, and many cases that are now lost could be saved if they were financially able to continue treatment for the proper length of time.

General Physical and Mental Makeup of the Patient. — Physically well developed people are not as liable to develop tuberculosis as the weak and undersized, and if the disease does develop, the prognosis is not so grave. The psychic factors play an important part in the prognosis, and the two following cases illustrate certain phases of this most important part of our study: —

Mr. K, a lawyer thirty-one years of age, was admitted to one of our sanatoria as a moderately advanced case of tuberculosis. He had signs of active tuberculous disease in the upper and middle lobes of the right lung. He was apprehensive and remained so during his entire stay in the sanatorium, was always talking about his case, and at every change in his temperature, pulse or weight had to be reassured as to the importance of the symptoms. When confined to the bed for temperature or pulse elevation, he was restless and did not get the benefit of the treatment. No amount of reassurance would give him confidence for more than a few minutes. He was not contented at the sanatorium and wanted to try some other place. The patient showed no improvement, lost weight, and all symptoms increased. He was discharged after ten months' treatment as unimproved, and died a few weeks after leaving the sanatorium.

Mr. C, a paper hanger, forty-eight years old, was admitted to the same sanatorium about the same time as Mr. K. This patient also had signs of active tuberculous disease in the upper and middle lobes of the right lung, but his mental attitude was the exact opposite. He never worried about any of his symptoms, and if kept in bed enjoyed himself. When up and taking exercise, he wandered about and saw all there was to be seen and was always amused. This patient felt that he was going to get an arrest of the disease. He developed some throat trouble, became hoarse, and although he knew how serious tuberculous laryngitis was, he did not allow it to depress him. A few months before his year at the sanatorium was up, he began to improve, and was discharged to continue his treatment at home. The patient was heard from three years after leaving the sanatorium. He was in fair health and able to do some work.

These two patients were very nearly the same type of case in regard to the area involved and the time that the disease had been active when they began the treatment; but one of them could not control his nervous temperament, while the other was philosophical and received all the benefit there was from the treatment.

There may have been other factors that influenced the prognosis in these two cases, but I believe the psychical factor played the most important part in the outcome.

Temperature, Pulse, Cough, etc. — The temperature and pulse are of the utmost importance and should be studied during the entire course of the treatment.

Barnes,[1] in his study of the subsequent histories of febrile patients, found that twenty-seven months after the onset of the fever, of 62 patients who had fever one to four weeks, 59.6 per cent. were dead; of 39 patients who had fever one to two months, 69.2 per cent. were dead; of 11 patients who had fever two to three months, 72.7 per cent. were dead; of 12 patients who had fever three to four months, 75 per cent. were dead; of 13 patients who had fever over four months, 77.7 per cent. were dead. He also is of the opinion that it is of comparatively little importance whether the average daily maximum temperature is 100°, 101° or 102° F., the duration rather than the height of the fever being the deciding factor in the prognosis.

The pulse rate is also of considerable significance aside from the temperature. Patients sometimes have very little elevation of temperature but do have a rapid pulse and one that is easily upset. In such cases, if the pulse rate is not improved by a few weeks of rest, the prognosis is bad.

In general, the cough in tuberculosis is one of the most marked symptoms and should be studied carefully. There are many patients who develop the cough habit and need instruction in methods to reduce such a cough, for all coughing that is unproductive is harmful. There are, however, patients who have from the first a harsh, teasing cough that no amount of rest and treatment seems able to control. This type of case is one that generally progresses rapidly from the beginning.

The physical examination does not as a general rule give us any clue to the cause of the persistent cough, but in most cases of this character the progress of the diseased area in the chest is rapid.

The character and the amount of the sputum have also to be studied with the cough. The patient who shows a gradual diminution of the sputum and a decrease in the cough, is beginning to improve, and the general appearance of well-being soon reflects this improvement.

Patients who lose weight when under favorable conditions, and who have stomach and intestinal symptoms at the slightest variation of their routine, require the greatest care; and there are many of these patients who do not respond favorably under any conditions.

The Rapidity of the Advance of the Diseased Area. — The advance of the pathological process in the chest is also of great importance in our estimate of the patient's resistance. The patient who shows gradual advance of the area involved in the chest from month to month, is one who has poor resistance, and the prognosis is bad in proportion to the rapidity of this advance; but the patient who shows a very slow advance of the diseased area and is able to check this advance easily as soon as proper rest and treatment are started, has a good prognosis.

Bacteriological and Chemical Study. — Researches in bacteriology and chemistry are constantly being made to aid us in the prognosis of tuberculosis, but up to the present very little has been accomplished in this direction. The virulence of the invading bacteria play an important part, but at present there is no way to determine this virulence.

In 1905 Arneth[2] published a paper in which he gave the results of his work on the blood in tuberculous patients. He observed that "there is a relationship between the state of the nucleus of the neutrophile of the blood and the condition of the patient in tuberculosis."

There have been many papers written on this subject since Arneth's work, but while some of the observers claim a study of this kind is of distinct value in estimating the prognosis in tuberculosis, other observers have felt there were too many factors involved to be sure of the result.

The chemical researches have also been extensive and varied, but the results have not been conclusive. The urochromogen and diazo tests have been studied for some time, but of late there has been renewed interest in these tests and some of the recent investigations would seem to show that the urochromogen test is of some value in estimating the prognosis.

In conclusion, we can say that there are certain classes of cases in whom we can look for an arrest of the disease: —

1. Patients with good inheritance and who are not subjected to massive doses of tuberculous infection.
2. Patients who have not lost their resistance by excesses of all kinds.
3. Patients who are in a position to continue treatment until they have arrested the disease and can start their work under proper conditions.
4. Patients who have very little temperature or pulse disturbance.
5. Patients who show good resistance, and in whom the pathological process advances slowly and is easily checked when treatment is started.
6. Patients who have little if any digestive disturbance, and who gain weight easily.
7. Patients in whom the cough and sputum gradually disappear after treatment is started.
8. Finally, a class of patients with "ability and willingness to undergo treatment."

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CONCERNING THE RELATIVE FREQUENCY OF INSANITY IN CITY AND COUNTRY.

By H. M. Swift, M.D.

According to figures given in the thirteenth census insanity is more prevalent in urban districts than in rural districts.

From the United States as a whole, the number of admissions to State insane hospitals during the year 1910 was 86 per 100,000 population from cities and towns of more than 2,500 inhabitants, against 41 admissions per 100,000 population from places of less than 2,500.*

In Massachusetts during the same year, the number of first admissions to State-receiving hospitals was 73 per 100,000 from places of more than 10,000 inhabitants, against 56 per 100,000 from places of less than 10,000.†

From Suffolk County, a very thickly settled district including Boston, the number of first admissions to State-receiving hospitals in 1910 was 80 per 100,000 population, against 62 per 100,000 from the remainder of the State.†

I thought at first that this difference might be due in considerable measure to a higher proportion of persons of foreign birth and parentage among the city population, but this is not true apparently. A comparison of the number of persons of native stock from Suffolk County first admitted to State hospitals with the number of the corresponding class from the whole State shows approximately the same difference. These numbers are 78 per 100,000 from Suffolk County and 60 per 100,000 from the whole State.

In regard to the relative frequency of urban and rural admissions among native-born whites for the United States as a whole, the census gives the following figures: from urban communities 73.7 per 100,000 population, and from rural communities 40 per 100,000.‡

It is of interest that in a few of the States occur exceptions to the rule that insanity is more prevalent in cities than in rural communities. In New Hampshire, Vermont, Rhode Island, Connecticut, Minnesota, Wyoming and Arkansas the admission from the rural communities shows a higher ratio than the admission from the urban districts.* In what respect conditions in these seven States differ from those in other States is a question apparently very difficult to answer. Why should the rural districts in Vermont furnish a higher ratio of admissions than the urban districts, while Maine, with a similar population, shows the reverse?* Or why, in Nevada, is the number of admissions per 100,000 population from urban communities three times larger than the corresponding number from the rural communities, while in the neighboring State of Wyoming the rural communities are apparently most afflicted?* Minnesota and Wisconsin offer a similar contrast.*

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* Thirteenth census, Insane and Feeble-minded, Table 50.

† The number of first admissions was obtained from the 1910 reports of Massachusetts State hospitals.

‡ Thirteenth census, Insane and Feeble-minded, Table 55.

In Maine the greater prevalence of insanity in urban communities might be explained in some measure by the facts that in these sections there is a higher percentage of foreign born among the population, and that from here the State institutions are more accessible. Differences in the distribution of the foreign-born population may also explain in part the higher urban admission in Wisconsin as compared with Minnesota. In many other States suppositions of this kind would not hold good. For example, in Rhode Island and Connecticut, where the rural admission is proportionately much higher than the urban admission, the disparity can be dependent neither upon the distribution of the foreign-born population nor upon differences in the accessibility of institutions, because in both States the percentage of foreign born is higher in the cities, and the hospitals are easily accessible. In general it is improbable that differences in the ratios of admissions from city and country can be accounted for to any extent in either of these ways.

It should be emphasized that the number used by the Census Bureau to form the dividing line between urban and rural districts is 2,500. All places above 2,500 are classed as urban. So it will be seen that the comparison is not altogether between what we generally understand by city and country, but also to some extent between small towns and very small towns.

It is perhaps generally assumed that the greater prevalence of insanity in cities is due entirely to unfavorable environment; that pure country air, better hygienic surroundings, and lack of crowding are peculiarly conducive to mental health. This assumption is apparently borne out by the fact that the admission rate is higher from the larger than from the smaller cities. From cities of more than 50,000 inhabitants the number of admissions to State hospitals in 1910 was 102.8 per 100,000 population, while in cities and towns of 2,500 to 10,000 this number was only 70.2.* From the technically rural districts, with a population below 2,500, the number of admissions per 100,000 falls to 41.* Thus it will be seen that the difference between the rural districts and the small cities or towns is the same as between the small cities and the large cities. This, I think, is important, because it tends to show that this difference cannot be dependent entirely upon congestion or other conditions generally regarded as peculiar to large cities. Towns or small cities below 10,000 can hardly be regarded as congested and it is hard to see why they should be more unfavorable to mental health than the rural districts, as technically understood.

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* Thirteenth census, Insane and Feeble-minded, Table 58.

The difference in admission rate between the purely rural regions and the small cities is particularly well marked in some of the sparsely settled States, as Nevada and Arizona. In 1910 there were in Nevada only two places above 2,500, — Reno, with 11,000, and Sparks, with 2,500. So here the comparison lies practically between the number of insane committed from a place about the size of Arlington, Mass., and the number from the rest of the State. Yet the number per 100,000 of urban admissions is three times as large as the corresponding number of rural admissions, — 157 against 51.† According to these figures the frequency of insanity is much greater in these two small Nevada cities than in the urban districts of populous eastern States, as New York, Pennsylvania or Massachusetts, with their many large cities. Nor does Nevada furnish the only example of high admission rates from small cities. The ratios from the urban districts of Arizona, Montana and some of the other western States are also very high.

It has seemed to me that differences in the prevalence of insanity in city and country were perhaps not due altogether to actual differences in environment, but might be explained equally well on the theory that persons and families with the insane predisposition tend to be drawn into the towns and cities, rather than to remain in the more isolated country regions. In other words, may not rural life tend to repel and urban life to attract certain pathological types of mentality?

To those who believe in the omnipotency of environment in general, this view will not be acceptable. To others, it may not seem unreasonable. It is naturally not susceptible of proof. Yet is it not equally as probable that the higher ratio of insanity in cities is dependent upon a tendency of the predisposed to drift to the more populous regions as that the environment in towns the size of Arlington and Billerica exerts some vague, noxious influence upon one's mentality, which is nonexistent in strictly rural places?

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* Thirteenth census, Insane and Feeble-minded, Table 50.

† Thirteenth census, Insane and Feeble-minded, Table 58.

There are two well-defined causes of insanity properly considered environmental which are apparently more potent in cities than in the country. These are alcohol and syphilis. Following the census reports for 1910, for the United States, as a whole, the ratio of general paralytics and alcoholics was 18 per 100,000 in urban districts, and only 4.3 per 100,000 in rural districts.*

The same tendency may be seen by comparing the frequency of general paralysis and alcoholic insanity among admissions in Maine and Massachusetts. This is a comparison between a sparsely populated State and a thickly populated State. In Massachusetts, in 1910, the general paralytics and alcoholics made 20 per cent. of the total admissions; in Maine, 16 per cent.

If general paralytics and alcoholics are not counted, the difference in frequency of insanity in city and country is considerably reduced. For the United States the number of admissions in 1910 for psychoses, other than general paralytics and alcoholics, was 68 per 100,000 from urban and 37.1 per 100,000 from rural districts. It will be seen that the difference here is less than between the total numbers of urban and rural admissions including all psychoses, namely, 86 and 41.

In my opinion, it should not be assumed that the disparity in frequency between urban and rural insanity is dependent entirely upon environmental differences. It may be explained equally well upon the supposition that persons predisposed to insanity tend to live in cities and towns rather than in the country.

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* Thirteenth census, Insane and Feeble-minded, Table 61.

CARDIAC ARRHYTHMIAS.

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Among noteworthy tributes to the modern laboratory not the least is our present-day knowledge of disturbances in cardiac rhythm. Largely through laboratory methods have the tremendous advances in this important field during the past few years been accomplished. To appreciate this one has but to turn to the works of Einthoven, Mackenzie, Lewis, Keith, Tawara, Bamberger, Hirschfelder, Gibson, Wenckebach, Riegel, Kahn, Cowan and others. The efforts of these investigators have made it possible to study the heart's action with great precision, and, as a result, the prognosis and treatment of its derangements are rapidly being placed upon a rational scientific basis.

The normal cardiac rhythm consists of a regular sequence of beats starting at the sino-auricular node; from here the impulse of contraction travels rapidly in all directions through the auricle, and on reaching the auriculo-ventricular node traverses this and the bundle of His, which is its continuation, and is distributed in a methodical manner through the Purkinje system to the inner ventricular surface. The stimulus originating at the sino-auricular node requires for its preparation a definite constant time which is relatively long, reaching two-thirds of a second in the normal heart. In the auricle the course of the excitation wave resembles, according to Lewis, the flow of a fluid poured on a flat surface, the edges advancing in widening circles. There is no increase in the rate of conduction to the auriculo-ventricular node, the impulse passing to it through the auricular muscle at the same rate as to other portions of the auricle. In the ventricle the methods of distribution of the impulse are entirely different, for through the ramifications of the Purkinje system the impulse received from the auricle is distributed at about the same instant to the different parts of the ventricle.

As is well known, if a heart be excised and placed under suitable conditions, it may continue to beat rhythmically for a long time. Thus it has been deduced that the site at which the stimuli for contraction are initiated is within the heart itself. According to the myogenic theory the contraction wave arises in the heart muscle and is conducted through the whole organ by means of the musculature. This view has largely displaced the neurogenic theory. Neither explanation alone, however, is entirely sufficient, and it is probable that a certain amount of nervous activity is necessary in addition to the myocardial function. In the mammalian heart the function of stimulus production is most highly developed in the specialized tissue of the sino-auricular node, which fixes the pace and rhythm of the whole organ; the other portions of the healthy heart, lacking this ability to originate impulses, beat only in response to stimuli, which are received in a rhythmic manner from the sino-auricular node.

Careful inspection of the pulsation of the jugular veins will show the rate and rhythm, in health, of the contractions of the auricles. The patient should be in a recumbent position with head low and the muscles of the neck relaxed. Though the pulsation may be seen, it cannot be felt with the examining finger. Watching the pulsations and at the same time feeling the apex beat, several impulses may be noted in the jugulars for each ventricular beat. If only two impulses are observed, the first corresponds to systole being synchronous with the apex beat and the first heart sound, the second occurring with or immediately after the second sound. If a third impulse is visible, it will be seen occurring immediately before the first sound, hence a presystolic impulse. Tracings of the venous pulsations taken simultaneously with the arterial pulse or apex beat by means of the polygraph give the greatest accuracy in determining the exact nature of these waves.

In the evolution of the heart muscle fibers, certain functions of the primitive cells were retained, some more highly developed than others according to the duties they had to perform, so that while the fibers have come most closely to resemble muscle, they nevertheless retain in a varying degree some functions akin to the nerve cell. The functions of the heart muscle are: (1) stimulation, — stimulus produced from chemical reaction; (2) excitability, — the ability to respond to a stimulus by appropriate function; (3) contractility, — the typical property of the myocardium as of other muscles; (4) conductivity, — the conveyance of contractile impulse; (5) tonus, — the condition of slight tension, or absence of complete relaxation. The heart carries on its work in consequence of its possession of these functions, and there are many important features in each which have a practical bearing on the symptoms of disease and the principles of treatment. The integrity of their functions depends upon the supply of suitable nutriment to the fibers and a sufficient time of inactivity to recover after their exercise. When a contraction takes place, all the functions have been exercised to the limit of the power possessed by the fibers at the moment of stimulation. No heart cell exhausts only a portion of its functions; when stimulated, it uses all the energy which it possesses. For a brief period after their exercise, the functions cease to exist. Recovery, however, begins at once during the period of rest, and each function in time regains its strength, so that, within certain limits, the longer the delay the more complete the recovery and the more efficient the subsequent action. It is by fully appreciating such effects of rest and proper nourishment that we gain the best conception of the principle which should underlie all treatment of cardiac conditions. While all the functions, when exercised, use all the force they possess, they nevertheless manifest a quality whereby they can respond under certain circumstances with greater activity. Thus the rate may be suddenly increased and at the same time the stimulus passed on from the auricle to the ventricle with increased rapidity and the contraction executed the quicker. These changes are to a great extent under the control of the nervous system, but they imply a quality possessed by all these functions which is of vital importance in the study of cardiac failure.

Thus the heart muscle presents two distinct phases, — an excitable and a refractory. Following a contraction, during diastole the heart cannot be stimulated to contract until an approximate level is reached after a given period of rest, then a stimulation of given strength initiates a contraction, which is not in proportion to the strength of the stimulus but is always maximal.

Irregularities of cardiac action can be grouped under five heads: —

1. Sinus or youthful.
2. Premature contraction or extrasystole.
3. Heart block (partial or complete).
4. Totally irregular pulse (auricular fibrillation).
5. *Pulsus alternans.*

SINUS ARRHYTHMIA.

Sinus arrhythmia is a difference in time rate of cardiac contractions with but little difference if any in their force. Venous and arterial tracings show that they are synchronous in detail. The irregularity is best seen in a slow pulse, since rapidity, by reducing the diastolic pause, has a tendency to lessen the abnormality. A similar form of arrhythmia may be produced in normal individuals by causing them to take forced inspirations. The pulse becomes more rapid during inspiration and slower during expiration. The cause of sinus irregularity is reflex, coming through the vagi, not originating within the heart itself. It occurs in young and neurotic individuals, and during convalescence from acute disease. It may never be observed by the patient, though the diastolic pause may be so prolonged in a few cases as to produce cerebral anæmia with syncope. Atropine may relieve the condition. The prognosis is favorable.

EXTRASYSTOLES.

Contractions of the heart may be initiated at some other point than the sino-auricular node. Such a stimulus may cause a contraction of the auricles alone, or the ventricles alone, or of both auricles and ventricles, producing a premature beat. This response to a heterotopic stimulus produces what is termed an extrasystole if the stimulus is strong enough after the refractory phase of the muscle has ended, though the physiological stimulus is not due. If some portion of the heart muscle is unduly excitable, then a relatively weaker stimulus than normal may produce an extrasystole.

Extrasystoles may occur in an otherwise rhythmic physiological beat, the auricles may beat rhythmically but the ventricles may contract prematurely, or both may show the premature contraction.

When premature beats of the ventricles occur, they may open the semilunar valves, thus transmitting a pulse wave into the arteries; or the valves may not open and no pulse wave be carried through. Hence the observation at times in a marked arrhythmia, that the pulse rate when counted at the wrist and at the apex shows a greater number of beats at the apex than at the wrist.

In most cases of extrasystole the rhythm determined by the sino-auricular node is not interfered with by the premature beat.

The pause following the extrasystole is of longer duration than that following the physiological beat, so that this pause is compensatory to the rhythm and the subsequent ventricular beats occur at the rhythmic intervals. A heterotopic exciting stimulus may travel back to the auriculo-ventricular node, and, disturbing its rhythm, the pause following may be even shorter than that of a physiological beat. If it is so short that the following beat is not retarded, it is termed "interpolated."

Extrasystoles may develop in any portion of the cardiac structure and are designated, according to their point of origin, as sinus, auricular and nodal (arising in the auriculo-ventricular node or bundle, also termed "supra-ventricular"). Ventricular extrasystoles refer to those arising in the branches (right or left) of the auriculo-ventricular bundle or in the ventricular muscle.

As a rule, extrasystoles occur singly, but a number may follow one another. Usually a patient will show only one type, the point of stimulus in the wall being the same.

Cases showing extrasystoles indicate an increased myocardial irritability and a definite impairment of cardiac efficiency. This defect may be slight and transient, as in the acute infectious disease, it may indicate the early approach of arteriosclerosis, or it may be associated with signs of decompensation, such as dyspnœa on exertion, precordial pain and œdema.

The clinical recognition of the extrasystole is made when an apparent rhythmic pulse is interrupted at intervals by a pulse wave occurring in advance of the normal beat. This advance wave is usually smaller in volume and is followed by a pause greater than the normal diastolic period. The following beat of the normal rhythm is usually of greater intensity. At times the premature beat will give no evidence to the finger on the pulse, appearing as though it were a "dropped" beat, but palpation of the apex reveals that the beat was present though too weak to open the semilunar valves.

Prognosis and treatment of the condition depend on relief of the irritable myocardium. If this can be accomplished, the condition responds to treatment, though oftentimes the failing myocardium cannot be restored.

ARRHYTHMIA IN HEART BLOCK.

One of the less common forms of cardiac irregularity, though one of the most interesting, is heart block. The impulse originating in the sino-auricular node may be delayed or entirely obstructed in its progress to the ventricles, resulting in a partial or complete heart block. The interruption may occur at the sino-auricular node, the auriculo-ventricular junction or at the inter-ventricular junction (dissociation of the ventricles). The most important is the auriculo-ventricular block. This may be either functional or organic. "Functional" block may result from excessive drug action, as the digitalis group, and occurs usually with a diseased bundle of His. Organic block is due to disease of the bundle of His or of the surrounding tissue.

A slow pulse with a lengthened "a" to "c" interval may be the first symptom of block. The block may increase and an occasional impulse fail to pass through the bundle, resulting in a loss of the ventricular beat. This may occur either at regular or irregular intervals, and if the block becomes complete the ventricle assumes its own rhythm, which is definitely slower than that of the auricle. Clinically, heart block is determined by the presence of the bradycardia, by the appearance of three or more impulses in the jugular vein for each arterial pulse wave, and especially by the presence of faint auricular sounds heard over the heart synchronous with the venous impulses. Such sounds may appear merely as faint tickings, but tracings with the polygraph and cardiograph show these significant contractions very distinctly.

In organic block the prognosis is grave, the cardiac capacity being reduced in proportion to the degree of block. If the case is specific, anti-luetic treatment may promote recovery, in others atropine often gives relief. Functional cases recover promptly upon removal of the cause.

Auricular Fibrillation.

One of the most frequent forms of cardiac irregularity is auricular fibrillation. It occurs more frequently in males, and after middle age. It is most common in chronic myocarditis, and in the later stages of mitral disease. The condition was formerly known as "delirium cordis," the "mitral pulse," "nodal rhythm," "*pulsus irregularis perpetuus*," etc. It is the most common of the cardiac irregularities, comprising more than one-half of the arrhythmias of cardiac insufficiency. Once established it continues uninterruptedly to the end of life though the heart may apparently revert to a normal rhythm.

Although the ventricular rhythm is wholly disordered, the ventricular beat as shown by the cardiograph is of normal form, indicating the stimulus received to be of supra-ventricular origin. Apparent changes of an inflammatory type are found in the myocardium, more marked in the auricular tissue, thus accounting for the increased excitability and defective conductivity.

In some cases fibrillation occurs after auricular extrasystoles have been present for some time, indicating an abnormal irritability of the muscle, the fibrillation being only a further development of the condition. In other cases, the quick onset of the attack and the relapse to the normal rhythm suggest that vagus influence is a cause, though atropine, by its action on the vagus, should restore the normal rhythm, it rarely does so.

As a rule, graphic records are unnecessary for the diagnosis of auricular fibrillation, though by their use characteristic tracings are obtained. The trained eye, finger and ear are usually sufficient to differentiate it from the other arrhythmias, the complete arrhythmia of the pulse being readily confirmed by auscultation of the heart. In the jugular vein one finds the presystolic "a" wave absent, the arterial or "c" wave alone being visible. In those cases where the heart is rapid and decompensation has occurred, many of the systolic contractions will give no evidence of a radial pulse.

In auricular fibrillation rest in bed and digitalis produce wonderful results, and the improvement of the patient in itself corroborates the diagnosis.

PULSUS ALTERNANS.

Pulsus alternans, though not a true cardiac arrhythmia, for the time between beats is usually the same though often associated with extrasystoles, occurs when the muscle is overtaxed, as in tachycardia, and particularly when the muscle is on the point of breaking down. It is seen particularly in tachycardias associated with impairment of the myocardium. The contractile power of the heart may be actually diminished, or the cardiac rate may be so increased, that the heart muscle is unable to contract effectually. As a result the pulse takes the type of "alternating," the alternate contractions of the heart being of varying size, some large and some small. It can be recognized at the wrist when a full pulse beat alternates with a weaker. Graphic records of the condition are characteristic. The prognosis depends on the cause. When a true myocardial impairment exists, as in most cases, it must be regarded as of grave significance.

The subject of irregularities, so briefly touched upon here, is a most important one in cardiac conditions, and should be made an object of close study by all practitioners. Though the various forms of apparatus now in use are of tremendous value, an accurate diagnosis can usually be reached without them. The prognosis and treatment in each case depend entirely on the correct interpretation of the particular type of arrhythmia.

SOME POSSIBILITIES IN THE TREATMENT OF THE TUBERCULOUS INSANE.

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In electing to discuss the subject proposed in the title of this paper, I find that I have rushed in where men of greater experience hesitate to tread, but if the proposed possibilities appear too fanciful or impractical for adaptation to the management of the insane, I trust that it will be understood that the suggestions arise wholly in my enthusiasm for the principles of sanatorium treatment of tuberculosis.

First to be considered is the detection of tuberculous disease among the insane. On admission, the patient's history of antecedents and of past and present illnesses, supplemented by information from friends and relatives, should disclose facts pointing to tuberculosis, if such exists. Physicians admitting patients are apt to follow their respective hospital inquiries too closely, neglecting a wider range of possibilities in the patient's previous illnesses. It is important to know about his general state of health for some time before he was sent to the hospital, if we are going to look for tuberculosis in this newly admitted patient.

It was estimated[1] that one-fourth of the tuberculosis, which appeared in patients in a group of hospitals for the insane over a given period of time, was present at the time of admission. The three-fourths portion was contracted within the institutions. The history is especially important then, for in a large number of cases very little co-operation may be expected from the insane patient in the physical examination. There is, then, a large field for the use of diagnostic methods, of which tuberculin is notable, as well as the X-ray. Wherever evidence of possible active tuberculosis needs confirmation, the use of tuberculin subcutaneously is valuable. Some skill is necessary in applying this diagnostic method, for without such skill, disappointing and disastrous results have occurred. Rapid loss of weight and vesperal fever are sometimes late symptoms, and too much reliance upon their absence would allow a tuberculous patient to go unnoticed for some time.

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* Deceased.

All cases of diarrhea which persist over the winter are to be regarded as suspicious of tuberculosis and if afebrile should receive diagnostic injections of tuberculin.

A Course of Tuberculin for Diagnostic Purpose.[2] — It is best in adults to give an initial dose of one-tenth of a milligram, take the temperature every two hours for a period of two days, and if the patient fails to react, to follow this injection with successive doses of 1, 3, 5 and 7 or 10 milligrams, similar observations on the temperature being made for an equal period between each injection. An initial dose of 10 milligrams may be followed by dangerous and even fatal consequences. Another method, together with certain deductions and limitations of the tuberculin test for diagnosis, may be found in Park and Williams.[3]

The contra-indications to the subcutaneous test are: certainty of diagnosis, fever, recent hemoptysis, advanced heart or renal disease, epilepsy, diabetes and convalescence from a severe infection.[3]

In a certain large, well-managed public institution 60 per cent. of the deaths for a period of twenty-one years came to autopsy. The autopsies numbered 2,102, and in 20 per cent. there was found active tuberculosis.[4] Latent tuberculous lesions were found in still larger number. In the report[5] of the autopsied cases in certain of the State hospitals in Massachusetts, there were 149 unknown cases of tuberculosis in a total number of 3,831 autopsies. Therefore, it is advisable to add the constitutional reaction of old tuberculin.

There seems to be a high correlation between dementia præcox and tuberculosis; 42 per cent. of the deaths from tuberculosis in all the Massachusetts State insane hospitals in 1905 were dementia præcox cases.[6] There is an age of onset coincidence in the two diseases, and, furthermore, such demented and untidy patients with the nutritive disorders associated with dementia præcox and allied mental diseases probably are more susceptible to infection. This group of insane patients would bear closer scrutiny.

More trustworthy patients are able to obtain daily out-of-door exercise, which appears to be the best prevention against tuberculosis among the insane.

If there were opportunities for open-air exercise for female patients to the same extent as for male patients, the female tuberculosis mortality rate would probably be less. It is now far in excess of the rate for males.

The section in psychiatry[7] at the thirteenth international congress in medicine, Paris, 1900, voted a measure favoring the isolation of the tuberculous insane and their treatment in special pavilions. It was brought out by Marie[8] that German institutions had already established this practice, following the decision of the congress of Berlin in 1899, and that for the purpose a so-called asylum-sanatorium type was set up at Lauenburg. In Italy[9] all admissions were subjected to diagnostic tuberculin, and suspicious cases isolated in a distinct pavilion. Marie[10] calls attention to the necessity of examinations of military strictness for all employees of institutions for the insane in the work of thoroughly eliminating all possible sources of tuberculous infection.

In 1908 Dr. H. Déclerc[11] stated: "Since tuberculosis, now a contagious malady, has so powerful an effect on certain psychoses it is necessary to isolate at first for the treatment of the individual patient, and furthermore to avoid its dispersion; this work will be the work of sanatoria." This author devotes his paper in the main to discussing the means of diagnosing tuberculosis upon the insane wards, and recommends tuberculin as a precise means, finding that the physical examination often fails to show up this disease.

In America, Hutchings,[4] Carrington[12] and other authors have discussed the need for isolation. Dr. A. E. McDonald, director of the Manhattan State Hospital, speaking of his own experience in this practice, stated: "The isolation of the tuberculous patients has reduced to a minimum the danger of infection of other patients, and of employees. The patients themselves have suffered no injury or hardship, but have, on the contrary, been unmistakably benefited."[13] A segregation unit is possible in Massachusetts with a transfer arrangement of tuberculous patients. With some definite system in operation, isolation should be as utterly complete as is possible. Under the present circumstances we hear that segregation "was more or less completely accomplished." The present day need is to eliminate the words "more or less" and to make segregation as absolute as human means can devise.

A classic example of what segregation[14] can accomplish appears in the experience of the State of Alabama in 1895–1902. Mortality from tuberculosis among the insane negroes in custody reached 51 per cent. Segregation in a special unit at Mount Vernon reduced this rate to 22 per cent. and kept it down.

The rate for whites dropped from 39 to 9 per cent., due to the relief from overcrowding and to isolation of the tuberculous insane.

Lately there were developed special units for the tuberculous insane in Florida, Kentucky, Wisconsin and Iowa. Some New York institutions for a number of years have maintained tuberculosis pavilions to which other hospitals transfer patients for treatment. These institutions have almost uniformly reported a decrease in the prevalence of tuberculosis, some characterizing it as a remarkable decrease.

The smaller cottage type of open wards with spacious verandas are preferred to the larger ward buildings. An abundance of fresh air, sunlight and absolute cleanliness must be remembered in planning construction, not only to protect the attendants but to aid in the recovery of the sick.[15] In the long run, tents are too costly and unsatisfactory, and should not be considered for more than temporary housing. This is our experience at North Reading.

The practice of New York in transferring their patients from one hospital to another, as mentioned in the foregoing, affords some explanation for the baffling nature of statistics concerning the tuberculosis mortality rate among the various institutions. Comparisons based upon this data are unfair either in New York State or Massachusetts.

The record of the Bureau of the Census published in 1914, dealing with "The Insane and Feeble-minded in Institutions, for 1910," reports: "The proportion of deaths caused by tuberculosis of the lungs is almost the same for the insane as it is for the total adult population, 12.9 per cent. of the total deaths in one case and 12.5 per cent. in the other." Analysis of this report adds very little of importance to this discussion and the only fact of interest is that the mortality rates for tuberculosis among the insane vary widely. The probable responsible causes in those instances of variance into which inquiry was made are not those expected, and so afford very little explanation why there should be more tuberculosis in one division of hospitals than in another. Such explanation, if afforded, would perhaps suggest remedies. Therefore, what seems necessary in the published reports is a tuberculosis morbidity rate. This would indicate how much tuberculosis was developing in each hospital and would obviate misleading conclusions, such as are now apt to be formed. A problem could then be worked out as to how many patients, who are discharged yearly from State hospitals for the insane, contracted tuberculosis in these hospitals, or, perhaps, took the disease home and out into the community.

In 1911 a canvass[16] of the State hospitals for the insane in the United States showed that 28 States were then making provisions for their tuberculous insane in special wards, tents, pavilions or by some form of isolation. The total capacity for this purpose amounted to 3,492 beds. The total number of the insane in custody of State institutions in 1910 was 187,791.[17]

At the international congress in 1899 in Berlin Dr. F. Liemens, in discussing the care of the tuberculous insane, described the arrangements at the asylum-sanatorium in Lauenburg.[18] Two wards, or barracks, for men and women, respectively, were constructed in 1896, each of 25-bed capacity, for sums equivalent to $5,000 each.

They were situated in open spaces amid pine woods at a considerable elevation. The open wards were not unlike the usual sanatorium construction of to-day, but the rooms for the disturbed tuberculous patients were uniquely planned. That is, there were many windows of thick glass placed high up on the walls, sanitary bases, terrazzo floors, and smooth, enamelled walls, the construction being so planned as to obtain a maximum of sunlight, of fresh air and of scrubbing brush opportunities.

Finally, since the business of segregating and caring for tuberculous patients of any sort presents difficult problems in itself, how is it fair to expect much if the management of the insane is to be handicapped by this added responsibility?

Segregation in separate units is one idea for consideration among the possibilities of solution of this practical problem.

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A CASE OF BOTHRIOCEPHALUS INFECTION.

By C. G. McGaffin, M.D., Kings Park, N. Y.

Bothriocephalus latus is a rare parasite in the United States, as evidenced by the small number of cases in American literature. However, it is thought that there are cases where the presence of the worm has not been discovered, so that perhaps it is not so uncommon as has been supposed. It is interesting to note that several observers, who have had their attention called to the parasite by finding it once, have discovered it in other cases. It should at least be borne in mind when treating foreign-born patients, especially Finns and Swedes.

Schauman, in Germany, reported cases in which the worm was harbored from childhood to old age, and cases have been reported in this country where the parasite had apparently existed many years.

It will not be necessary to describe the parasite here, except to point out that it is the largest of those found in humans, and that the separate segments have the sexual pore opening in the median line in distinction from the Tænia, in which it opens on the side. French Switzerland and the Baltic provinces of Russia are the centers of distribution.

Bothriocephalus is acquired by ingesting its plerocercoids with various fresh water fish, in whose internal organs and musculature they live. The fish are not well cooked, or certain portions are eaten raw, and the cycle is thus started in a new host. The development of this so-called "broad tapeworm" is rapid, Braun stating that in some experiments he made the average number of proglottides formed per day averaged 31 to 32 for five weeks, with a length of 8 to 9 centimeters. The symptoms of the parasite's presence in the alimentary tract are not constant in their character. In many cases they are trifling and again, in others, they are intensely severe. There may be gastric disorders and nervous symptoms, with melancholia; in a number of cases there is severe anæmia. Anæmia is not a common symptom, however, and is apparently not influenced by the number of parasites, or the duration of the infection. R. L. Wilson reported a case of multiple infection in which there were thirteen worms with an aggregate length of 319 feet; the known duration was over five years, but there was no noticeable anæmia.

On the other hand, one of Edsall's cases gave a red cell count of 662,000 at one time with a known duration of infection of only six weeks, while the count in the case I am reporting was 651,000 with unknown duration of infection. So the finding of the eggs in the feces is the real diagnostic sign.

The case which forms the basis of this paper is offered, not so much as a curiosity, but for the fact that the presence of the worm was masked by physical symptoms which apparently had no relation to it. Unfortunately death resulted and the parasite was found post mortem — the correct diagnosis having been made, however, a few days previous.

E. F., female, aged thirty, admitted to Long Island State Hospital Feb. 18, 1910. Born in Finland; father dead, mother alive and in Finland; two sisters and one brother — one sister is married in California, the other sister had been a patient at Kings Park. Patient came to the United States in December, 1906, and had worked as a domestic servant; when working out seemed to find it hard to get along with people; was cranky and irritable and could not keep a position. Could read and write.

For a year past she had acted and talked queerly; thought people were talking about her and that they had a machine that could know everything concerning her; also heard voices talking to her in her native tongue.

On admission, skin and mucous membranes good color; hemoglobin 85 per cent.; physical examination negative.

Mental Examination. — Was quiet and orderly; partially oriented; hallucinations of hearing which could not be described but were annoying — plugged her ears with cotton in endeavoring to stop them. Following admission remained quiet and orderly; hallucinations active, and states that she is influenced by a machine affecting various parts of her body. "Sometimes I get very hot in the head; they boil my head." "Make me sick to my stomach." "That is a terrible machine." Continued without change and was transferred to Kings Park State Hospital on May 8, 1911.

In August, 1911, complained of headache and dizziness, and was in bed about ten days; temperature, 100.6° to 102.5°. August 17, chest was examined and found negative. August 23, was up and dressed and appeared normal. Mentally no change.

In February, 1912, said, "I am feeling no good — sick all the time — nervous — like tired; can do nothing." Complained very often of headache. In April, complained of headache, and note states, "she looks pale;" some cough, but no expectoration; Von Pirquet test positive. Evening temperature 102°. Some dullness over left apex with a few fine rales. Reported as a case of tuberculosis. September, 1912, vomited and complained of feeling weak. Temperature, 104.8°. Blood examination for malaria and Widal negative. Examination of heart showed "mitral insufficiency and endocarditis." Splenic dullness increased;

diarrhea. Was treated as a case of typhoid. Made a good recovery from this condition and was up in eight weeks. Gained in weight from 110 pounds in June, 1912, to 136 pounds in March, 1913. Coughs, but there is no expectoration. In June, 1913, said to show good healthy color; physical examination shows infiltration of left upper lobe. Mentally unchanged. In September, 1913, "does not cough or expectorate." There was a gradual loss of weight beginning July, 1914. Temperature ranged from 98.4° to 100.2°. In December, 1914, appeared weaker and spent a few days in bed, but was soon up and in her usual condition.

January 9, 1915, was noted as again showing marked weakness; complains of general malaise with frontal headache, and shows considerable anæmia. Vomiting became an annoying symptom. Frequent loose cough, but the anæmia and cough seemed out of proportion to the findings in the lungs. January 23, 1915, red cells 651,000 — blood smear shows macrocytes, poikilocytes, an occasional myelocyte and nucleated red cell; white cells are diminished in number. Diagnosis of infestation by *Bothriocephalus latus* made. Patient seemed too weak for vermifuge; failure was rapid and death occurred on Jan. 25, 1915.

Necropsy was performed sixty-four hours post mortem. Body is that of a well-developed, fairly well nourished young white female; height, 159 centimeters. Weight, 97 pounds. No bruises or abrasions; pupils regular in outline — equal — 3 millimeters in diameter.

Ventral Section. — Abdomen is flat; panniculus 1 centimeter in thickness; abdominal muscles thin and pale; some fat in greater omentum, which is well developed and covers the contents of the cavity completely; the intestines appear very pale, almost transparent, and are distended with gas; appendix is normal in position and appearance, 5 centimeters in length; diaphragm normal; no adhesions or exudate in abdominal cavity.

Thorax is small, but well developed; mammæ pendulous; pectoral muscles thin and pale; costal cartilages show no change. The lungs, with the heart, completely fill the cavity; there are slight adhesions on both sides, but they are easily broken up; no fluid in the pleural cavity.

Pericardium is normal. Heart weighs 380 grams. There is some fat on the surface; the cavities contain a small amount of fluid blood which appears very pale and watery, with no clots; myocardium is pale and flabby; mitral valve shows some thickening along the edges; other valves negative. There is no thickening of the vessel walls and no varicosities. The lymphatic system shows no hyperplasia, or other abnormalities.

Trachea and bronchi show nothing of note. Pleura thickened at apices. Right lung weighs 494 grams. The tissue is of about normal appearance; no tubercles are noted in the gross; there is some œdema and congestion, but substance crepitates throughout. Left lung weighs 435 grams. It is similar in all respects to the right.

Esophagus normal. The stomach contains a small amount of light colored fluid material; mucous membrane pale; no hemorrhagic areas.

Intestines are somewhat distended; walls very pale. On opening the small gut it is found to contain a large *Bothriocephalus latus* measuring 24 feet in length. Microscopic examination of the fluid contents of this portion of the intestine shows many of the ova of this parasite. Large intestine negative. Liver weighs 1,495 grams. Surface is smooth and on section the tissue is pale and appears waxy in consistency. Gall bladder contains a small amount of normal looking bile; no stones. Pancreas weighs 130 grams; is large and soft.

Kidneys, weight 320 grams. They are large, soft and light in color. The capsule strips easily; cortex and pyramids are well made out. No fat in the pelvis. Ureters and urinary bladder normal. Uterus and appendages normal.

Spleen weighs 120 grams. The capsule is not thickened and on section the pulp is pale and soft; no increase in trabeculæ. Adrenals weigh 25 grams and appear normal. Thyroid not examined. Pituitary normal.

The scalp is covered with a good growth of light hair; it is not thickened and strips readily from the bone. Calvarium is normal in shape and character. Cranial capacity is 1,303 cubic centimeters. Dura mater weighs 50 grams — normal. Piaarachnoid is thin and pale, and shows no exudate. Brain weighs 1,245 grams before dissection and 1,235 grams after dissection. Cerebrospinal fluid is not in excess. Vessels show no sclerosis — substance markedly anæmic. Cerebrum shows no atrophy, the gyri being well filled out and the surface pattern is regular; ventricles are smooth, and on section there is nothing noteworthy. Cerebellum, pons, and medulla normal in the gross. Spinal cord not removed; upper section normal.

Microscopically, the heart showed slight fatty infiltration. The lungs showed thickened pleura, some infiltration of leucocytic exudate, and much œdema. No evidence of tubercles. Liver presented a thickened capsule — much fatty infiltration with some degenerative changes. Spleen, capsule thickened; much increase in the red cell content of the pulp. Pancreas, great amount of fat replacement, with some areas of degeneration. Kidney, capsule thickened; much cloudy swelling of tubular cells. Cerebral cortex, Betz cells showed acute cell changes and there was some degree of satellitosis — deposit of yellow pigment in cell bodies. Cerebellum, nuclei of Purkinje cells are not well made out; otherwise negative. Cord, ependyma of central canal much proliferated; polar cells of anterior horns show loss of granules and nuclei are faint.

The case presents several interesting points. The duration of the life of the parasite is uncertain, but surely it must have existed prior to the patient coming to the United States, or over eight years at the time of her death. Might not the acute attack in the fall of 1912, which was treated as typhoid, have been a toxæmia caused by the parasite?

The presence of anæmia of such an astounding degree in some cases, and none in others, is a very puzzling condition and one for which no adequate solution has been offered. In this particular case the physical signs in the lungs, together with the temperature, masked the condition in the intestines and in fact there was no symptom of the bothriocephalic infection until the anæmia became such a prominent characteristic. There was no diarrhea to point to intestinal disturbance, and no segments of the worm were found in the stools. It is an unfortunate characteristic of the broad tapeworm that it does not give up portions of its anatomy by which it may be identified. No examination was made for the ova.

It is important to remember that in individuals from the Baltic countries, especially, the *Bothriocephalus* is a frequent parasite and in some cases, perhaps, an examination of the feces for the ova of the worm will clear up a puzzling case. Again, the worm may exist for years and give no apparent symptoms, and then suddenly begin to develop in its host a severe toxæmia. Finally, the patient need not necessarily be a recent arrival in this country to present symptoms of *Bothriocephalus* infection.

PROGNOSIS IN MANIC-DEPRESSIVE INSANITY.

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Upon the basis of outcome largely rests the classification of the two great psychiatric entities, the manic-depressive and dementia præcox groups, when, not seldom, other differentiating means fail us. Of the notable advances in modern psychiatry, perhaps the most important was initiated when a survey of experiences led to a division of cases into classes founded upon prognosis, as favorable or unfavorable; or, perhaps, better to say groups with a tendency to a chronic course and deterioration as an outstanding characteristic, and groups with a tendency to recovery and recurrence without special liability to deterioration. In a general way, the latter characteristic distinguishes the manic-depressive insanities from all others.

The fundamental and distinctive feature of the manic-depressive insanities, affect-disturbance, is so common in experience, physiologically and pathologically, that it would seem to offer no insuperable difficulties to recognition. Trial and practice furnish proof to the contrary oftentimes. It cannot be supposed, therefore, that the lines dividing this from other forms of insanity are as yet definitely drawn, or that the issue in a given case may not be at variance with the expectations that apply to the general. Affect-disorder touches upon, and forms an important element in, the symptom-complex of other insanities distinct from the manic-depressives. Hence arises conflict and uncertainty of diagnosis in the earlier stages of this and other forms of mental disturbance allied by symptom manifestations. In the final outcome of attacks, however, recovery and recurrence without special tendency to marked early deterioration are so commonly identified with the manic-depressives that instances to the contrary raise a question as to the diagnosis.

The problem of determining in advance the outcome of any case of manic-depressive insanity is anything but simple. Oftentimes what may appear as the chief causative agency is so overlaid by additions, physical, constitutional or environmental, that precision in prognosis is seriously handicapped. And yet one cannot be satisfied with the general conclusion that the outlook for recovery from the individual attack is good, but with tendency to recurrence. The practical questions of the duration of attack, probable length of free interval, and recurrence confront us daily in our relations with patients and public. The majority of us have to make particular and fragmentary experiences the basis of such opinion as we may hazard in our answers; nor can we discern beyond the lines of empiricism a guide to a better or a more scientific judgment.

A statistical study of cases in this connection possesses more than mere academic interest. Properly considered, it furnishes a measure wherewith to subject empiricism to the conditions of experience. It is proverbially open to fallacy. Nothing in the world, the remark goes, is so fallacious as figures, except facts. Making due allowance for various possibilities of error in statistical analysis, it still remains true that our conjectures as regards prognosis shall draw near to probability the more extensive the means of comparison, and the more closely they conform to deductions gathered from experience with numbers of related cases.

To determine whether any constancy, relative or absolute, exists in the sequence of phenomena of this disease, seems a fitting object of a review of cases. Is it possible to discover by retrospective analysis something of the nature of a common denominator rendering more exact judgment of cases possible, and to what degree are we encouraged by past experiences to predictions regarding course and outcome? Or are our opinions in the matter at best but expressions of belief qualified by conditions to which diverse solutions might attach according to times, places and circumstances?

With these questions in mind, this analysis of 451 cases diagnosed manic-depressive at the Danvers State Hospital was undertaken. The cases were taken consecutively according to first admissions and determined diagnoses, rather than selected for special features. Grouped according to the age-periods at which the first attack occurred, they stand as follows: —

AGE-PERIOD AT FIRST ATTACK.	Males.	Females.	Totals.
Pubescent-adolescent (up to 25 years), .	36	80	116 or 25.7 per cent.
Mature (25 to 40 years), ...	44	132	176 or 39.1 per cent.
Climacteric (40 to 60 years), ...	47	100	147 or 32.5 per cent.
Post-climacteric (60 years upward), . .	4	8	12 or 2.6 per cent.

Classified according to the type of the first attack, the cases may be arranged in the following order: —

Number of cases in which first attack was of the depressed type, .	245
Number of cases in which first attack was of the manic type, . .	152
Number of cases in which first attack was mixed in type, or with involutional modifications, ...	54

TYPES OF ATTACKS AND TENDENCY TO RECURRENCE.

Our analysis confines itself mainly to first and second attacks, partly because these, with their attendant conditions and circumstances, are of the most importance in relation to outcome, others with modifications of duration, phase and interval claiming interest chiefly as periodic reflections of tendencies already established; partly because a more comprehensive study would end in a bewildering array of results, and consequent confusion.

In 295 of the 451 cases, histories of recurrent attacks were obtained. The number of such in individual cases ranged between 1 and 20. In 100 cases all the attacks were of the depressed type. In 128, all were manic, but in most of these transitory phenomena of slight depression ushered in or terminated the attacks. Attacks of circular or alternating type occurred in 20 cases, and in 149 the type of attack was irregular.

An adequate idea of the tendency of cases towards establishment of the complete manic-depressive cycle does not follow from this tabulation. In a considerable number of all our cases, the life history subsequent to discharge from the hospital was incomplete or unobtainable. Of a group of 100 cases in which results of analysis could not be vitiated by this deficiency, 78 showed in one or more attacks variation of type, that is to say, a completion of cycle; 22 presented attacks of one general type throughout, but differing in order of occurrence, duration and intensity, and of these almost two-thirds were recurrences in the form of depression.

The tendency to recurrence seemed slightly greater in men than in women of all ages (66 per cent. of male cases recurring to 65 per cent. of women). It was greater in cases originating with excitement (manic and mixed).

INTERVALS BETWEEN ATTACKS.

Where the first attack was a depression, the average interval between first and second occurrence was 10.6 years for men and 10.9 years for women, as against an average of 6.1 and 6.5 years, respectively, when the first attack consisted of excitement.

Of females, 67 per cent. of the cases beginning with depressions showed an average free interval of ten or more years; 23 per cent. an average interval of five to ten years, and 10 per cent. less than five years. Of males, of the corresponding depressed group, 55 per cent. had average free intervals of ten or more years; 33 per cent. intervals of five to ten years and 12 per cent. less than five years between first and the following attack.

In this respect, the outlook for cases beginning with excitement (manic and mixed) appears by contrast less favorable. Female cases of this group, with initial excitement, averaged in numbers 60 per cent. with free intervals of less than five years, 21 per cent. with intervals of five to ten years, and 19 per cent. with intervals of ten or more years. The corresponding average percentages for males were 43 per cent., 33 per cent., and 24 per cent.

Intervals varied widely in individual cases. The longest free interval for females of the depressed group was forty-four years (first attack at fifteen; the shortest two years. For males, the extremes were twenty-eight years and one year. Following first attacks of excitement, the longest interval was twenty-eight, the shortest two years for females; for males, thirty-nine years and one year or less. Between these extremes individual cases presented a bewildering variety of interval durations, many without any apparent order or regularity of succession and duration.

AGE IN RELATION TO FIRST ATTACKS.

Grouping all our cases according to age at first occurrence, the period of maturity stands out prominently as the one most fruitful in originating attacks. An even higher incidence than that represented by our tabulation is obtained, if allowance be made for the variation between the periods of maturity in the sexes. Basing our calculation upon physiological epochs according to sex, the ratio of first occurrences, for both sexes, would be approximately 40 per cent. (for the mature period) to 33 per cent.

(climacteric), 25 per cent. (pubescent-adolescent), and 2 to 3 per cent. (post-climacteric).

Reckoning thus, the incidence of first occurrences in males becomes approximately 39 per cent. (for period of maturity), 33 per cent. (climacteric), 25 per cent. (pubescent-adolescent), and 3 per cent. (post-climacteric); for females, 41 per cent. (maturity), 31 per cent. (climacteric), 25 per cent. (pubescent-adolescent), and 2 per cent. (post-climacteric).

Tendencies of Cases originating in Period of Maturity.

Besides the special tendency in our cases towards origination of the disease in the period of maturity, the tendency to recurrence within the same period was remarkable. Relatively the number of these recurrents exceeded the total number recurring within the pubescent-adolescent, or climacteric periods of origin. Seventy of the 176 cases which had safely passed through the storm-periods of puberty and adolescence recurred here at intervals varying between seven and one years. Exceptional cases were found with intervals of from ten to fourteen years, — one as long as twenty-eight years, — but the number of such was relatively so small that the average length of the first interval in both men and women did not rise above 8.8 years.

In general, it was found that first attacks of excitement between the ages of twenty-five and forty were followed by a longer interval in men than in women, the ratio being 6.6 + years in men, as against 5.3 years in women. In cases of depression arising in this period, the average free intervals between first and second attacks were about equal in men and women, and slightly exceeding in length the average first intervals for depressions in men and women of all ages.

This group also contributed 76 cases with 145 attacks to the total number of cases with recurrences in the climacteric period, and 15 with 26 attacks recurring in the post-climacteric period. The increment thus bestowed upon succeeding periods constituted 50.3 per cent. and 30.6 per cent. of the total number of recurring cases of the climacteric and post-climacteric epochs respectively, representing 61.1 per cent. and 29 per cent. of the total recurring attacks of these periods.

All our evidence, therefore, indicates a striking tendency towards the development of this form of insanity at this stage of life. Whatever may be the influence that determines occurrence at this period, the outlook as regards freedom from recurrence is not wholly promising. Contrasted with the pubescent-adolescent group, recurrent cases constituting 73 per cent. of the total originating between 25 and 40 averaged 3.3 attacks, as against 2.3 attacks for 71 per cent. total recurrents of the former period.

TENDENCIES OF CASES ORIGINATING BETWEEN FORTY AND SIXTY.

After the age of forty, recurrences occurred at shorter intervals. This was specially marked in manic cases, the average intervals being 3.8 years for men, and 1.5 years for women. Notable exceptions, however, were not lacking. From this age onward, the intervals became shorter for the depressions. After forty-five years of age, the average intervals between attacks of first depressions fell to approximately the same length as that following excitements. The number of cases recurring averaged 63 per cent. of those first occurring after this age. Recurrences, which in many instances might perhaps be more properly termed relapses from remissions with return of leading symptoms, averaged 4.4 attacks per case. A considerable proportion of these cases terminated in chronic states or death during the first or second attacks, while others were discharged as improved where the distinction implied simply a certain quietness of mind coincident with improvement in general health.

Comparing first occurrences in men and women during the involutional or climacteric periods, the attention is arrested by results almost equal for the sexes, with the balance of greater liability on the side of the males. Certain contributing factors, aside from age influence, as alcohol, possibly helped to swell the number of male cases at this period. The fact could not be overlooked, however, that, where such influences obtained, the same factors existed during the period of maturity but failed to effect in respect to exciting a manic-depressive attack. Leaving out of consideration extraneous features common in greater or lesser degree to all periods, the evidence warrants the conclusion that a special vulnerability of the nervous system appears during this period, and that the susceptibility to mental disturbances of the manic-depressive order in this epoch is at least as great in males as in females. The number of cases under review is too small to justify dogmatic inferences, but the findings attain greater significance in their correspondence with the results of analysis of 3,000 cases of melancholia by S. Weir Mitchell, which seemed to dispose of the idea that women were more liable to melancholia at or about this critical period.

FINAL OUTCOME.

Cases originating during Puberty and Adolescence.

The cases originating in the periods of puberty and adolescence resolved themselves into two divisions in respect to final outcome. In about one-third of the number in whom it would appear the external circumstances and relations of life determined the attack, the outlook for complete recovery was good. It was not unusual for second attacks to occur in this group before the end of the thirtieth year, under the dreary persistence of vicious environmental conditions, but the end-results were favorable, the duration of the attacks short, varying from one to four months.

Where the attacks occurred in quick succession, as a rule the outlook was exceptionally unfavorable. Three or four attacks occurring up to the age of twenty-five generally presaged a chronic termination, or a mental reduction of varying gradation short of downright dementia. In many respects such cases bore singular resemblances to the milder types of dementia præcox, suggesting a composite picture with the manic-depressive coloring more conspicuously in the foreground.

Another group of generally unfavorable outcome embraced a number of cases where excitements or depressions appeared as exaggerations of habitual constitutional tendencies. Here frequent recurrence, brief free interval, and irregular duration of attack, was the rule. While in general the duration of life did not seem shortened, the attacks occurred in such rapid succession that a large part of it had to be passed in hospital confinement.

Cases originating after Age of Twenty-five.

From this age onward till the age of forty-five, short duration of attack offered prospect of a long, free interval, or occasionally no recurrence. The number discharged recovered within six months of the onset of first attack amounted to 65 per cent.; after twelve months of illness, 21 per cent.; after twenty-four months, 10 per cent.; and after attacks of longer duration, 4 per cent. of the total recovery discharges of the whole period after the age of twenty-five.

The recovery curve for men reached its height between the fifth and sixth month; for women between the fourth and fifth month following onset; from which points the declination was rapid. Individual exceptions of seemingly good recoveries occurred following attacks of over three years' duration.

Beyond the age of forty, permanent recoveries from first attacks were rare. Temporary recoveries were more often recorded, but in the majority of cases, the restoration of mental health did not progress beyond an improvement, ranging in degree from a return more or less complete, of former tastes, habits and interests, to the disappearance of leading symptoms, but with the persistence of abnormal features, instability, irritability and intellectual dulling, not serious enough, perhaps, to prevent the taking up in part of habitual or simple occupations. Depressions, especially in the case of women, seemed to offer the least hope of favorable outcome at this age.

Contributory Factors.

Among the factors of pathogenic importance, general opinion assigns a prominent place to hereditary influences. Forty-three per cent. of our cases furnished evidence of insanity or neuroses in the ascendants or near relatives. The indefinite information available in many cases regarding ancestry, or the lack of any information ofttimes, renders it probable that this percentage represents somewhat more nearly the minimum rather than the maximum of members with psychopathic or psychoneurotic antecedents. Quite as frequently as insanity, a neurotic, unstable make-up in the direct ascendants seemingly contributed a share to the sum-total of pathogenetic forces. Where the hereditary patrimony included evident innate defect, the prognosis was decidedly gloomy; in others the existence of apparent familial tendencies to mental disturbance did not seem to becloud the issue specially. A case in point was that of an attack of depression with an attempt at suicide in a girl of eighteen. Attack lasted three months, when a gradual improvement began, ending in recovery four or five weeks later; married at twenty-four; first childbirth at twenty-six, no symptoms of mental disturbance during or following pregnant state. Two more children born between twenty-six and thirty-five. Health good and mental condition normal up to forty, when further record of case ceased. Heredity included an insane mother who committed suicide, a maternal uncle one-time patient in an insane hospital, and a father alcoholic. In many of the cases where heredity figured as a possible predisposition, the outcome compared favorably with that in others not burdened, so far as record shows, with the incubus of destiny identified, in popular opinion, with such descent.

Alcohol figured next in importance to psychical factors in the tables of assigned causes. In very many of these cases, the basis for assuming an alcoholic etiologic influence appeared insufficient. A large proportion of cases of depression in men over forty yielded to scrutiny a history of alcoholic habits, light or excessive, at some period in early or late maturity. A very small portion of these had ever suffered an alcoholic psychosis proper, and a relatively insignificant proportion an affective psychosis during that space of time when the habit existed. Doubt arises as to the accuracy or value of hospital statistics in this respect, the data being insufficient, and the grounds upon which they are based often questionable. Where alcoholic habits occurred with the psychosis, in later life, the proportion of recoveries and improvement was decidedly lessened. Intervals, when such occurred, were short, in both manic and depressed conditions.

In 22 cases, pregnancy, childbirth or lactation was assigned as a cause. In 4 cases, no history of later attacks occurred. In 8 other cases, later histories were lacking by reason of changes of residence to other States or foreign countries. Recurrences were recorded in 10 cases. Of these, 4 had their first attacks at from three to six years prior to the first pregnancy. Later attacks occurred in 3 cases without a pregnancy, and in 3 cases later attacks followed later pregnancies. Fifteen, or approximately 73 per cent. of the cases, made good recoveries from attacks following the first pregnancies. The prognosis did not seem to be especially darkened where pregnancy seemed to occasion later attacks. Duration of such attacks did not differ materially from that in recoverable cases assigned to other causes.

By far the greatest number of cases were assigned to psychical causes; domestic infelicities, worry and disappointments, deaths of friends or relatives, love affairs, emotional shocks, etc., either singly or in combination with physical causes. In 7 cases where it appeared the psychic factor was the direct and only causative agent, the attacks were of brief duration, averaging three months, with permanent recoveries so far as the record goes. Where psychic disturbances precipitated an attack in a person without conspicuous innate psychopathic traits, the outlook on the whole was most favorable. While in numbers these cases are pitifully few, the fact is worth recording on account of its bearing upon measures of treatment and prophylaxis. Against the general gloom of pessimism prevailing in regard to permanent cure or abridgment of course in this disease, even so feeble a beam of hope suggesting possibilities of restorative influences and prophylactic assurance may serve to cheer and encourage the earnest worker in this field of medicine.

No compiling of figures, however extensive, will enable one to attain to a clearer vision of the manic-depressive field, if the unseen elements in cases, which often nullify our wisest calculations, the factors of environmental and social influences, are not considered. Equally important must be the anatomical and physiological conditions, the organic processes, which we are persuaded underlie some at least of these cases of seeming biological disturbance; and here the path from symptoms to primary cause ends in a wilderness of doubt and obscurity. The subtlest analysis based solely upon arithmetical considerations must miss the essential point of the matter, since the values of contributory affect factors are not susceptible of exact estimate in quantitative terms, while the existence and influence of organic causes, and what they may be, in any or all cases, remains and for a long time will remain, a speculative question.

Conclusions.

Statistical analysis is not of value in establishing rules or laws regarding the affective psychoses. It serves to confirm opinion concerning tendencies which may have already become a matter of not uncommon experience. Many important elements escape detection, or are impossible of arithmetical consideration, which have a profound influence upon course and outcome in this form of disease.

The tendency as to outcome is generally more favorable in the depressions than in excitements, intervals being in general longer, and the possibilities of non-recurrence greater.

Manic attacks or excitements first occurring at forty or later are of unfavorable outlook, the duration of attacks being generally longer, the intervals shorter. Such cases show greater tendency to chronicity after this or later attacks.

In attacks of depression first occurring after forty, the tendency of a lengthening of attack duration, and shortening of intervals, begins.

After fifty, in both males and females, manic and depressive attacks approximate more closely in duration of attack and length of interval. The tendency to chronicity of depressive conditions sooner or later in the course seems greater in cases first occurring at about this period, or somewhat later in life than is the same tendency in manic conditions.

The majority of cases show a tendency to first occurrence between the age of twenty-five to forty. Attacks first occurring in this period seem more prone to recur.

The influence of the climacteric in originating attacks does not appear greater in women than in men. Other things equal, the outlook for attacks in women at this period is not more serious than in men.

Recoveries, or marked improvements, are more common in cases of attacks of one to six months' duration. Following eight or more months' attack-duration, the probabilities of recovery or marked improvement diminish in proportion as the duration of the attack lengthens. After a twelve months' duration of attack, changes for the better assume more of the nature of remissions.

Innate constitutional defects are usually associated with tendencies to irregular forms of attack, frequency of occurrence, and a degree of deterioration more or less marked in the later periods of life. Attacks excited by emotional causes solely, in the absence of constitutional abnormalities, tend occasionally to permanency of recovery on the removal of causes which occasioned them, and a readjustment of environmental and social conditions. Psychic factors apparently predominate in the determination of attacks, and mental prophylaxis directed with sympathetic understanding and insight into the patient's life and personal characteristics would seem to offer hope of brighter prospects in some cases than has heretofore obtained under the influence of the doctrine of recurrence and predestined incurability.

THE CENTRAL CANAL OF THE SPINAL CORD.

By S. P. Kramer, M.D.,

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In March, 1912, I called attention to the possible importance of the central canal of the spinal cord in the pathogenesis of poliomyelitic disease. I was able to demonstrate in the dog, by the injection into the spinal canal of vital stains, a circulation of cerebrospinal fluid upward through the central canal of the cord to the ventricular system of the brain. Available literature on the central canal in the human subject is very limited. All authors agree that it is open in the lower animals and in young children. In the adult, the results of investigation vary. Bidder, Wagner, Schroeder Von d. Kolk and Stilling held that the central canal persists in adults. Koelliker found that not infrequently the canal was obliterated in places, most often in the cervical region. Clarke also found the canal frequently blocked. Frommann found the canal open throughout its entire length in three out of the 25 adults' cords examined. Owing to the kindness of Dr. E. E. Southard of Harvard University and Dr. George M. Kline, superintendent of Danvers State Hospital, I was able to go over the material at the latter institution for the purpose of determining in what percentage of adults the central canal was patent throughout the length of the cord. In all, 206 spinal cords were examined. At Danvers they had preserved these cords, as well as sections from the lumbar, dorsal and cervical segments. These sections were first examined, and when the central canal was found open in all three sections of a given cord, the cord itself was set aside for further investigation. Such cords were then sectioned 5 millimeters apart throughout their length. The segments were examined with a high power lens to determine whether the central canal was open at every point of section throughout the length of the spinal cord. Now as to the results: of the 206 cords examined the central canal was open throughout in 15 instances, or 7.23 per cent. A table follows showing the incidence of an open canal in the different decades as they were found: —

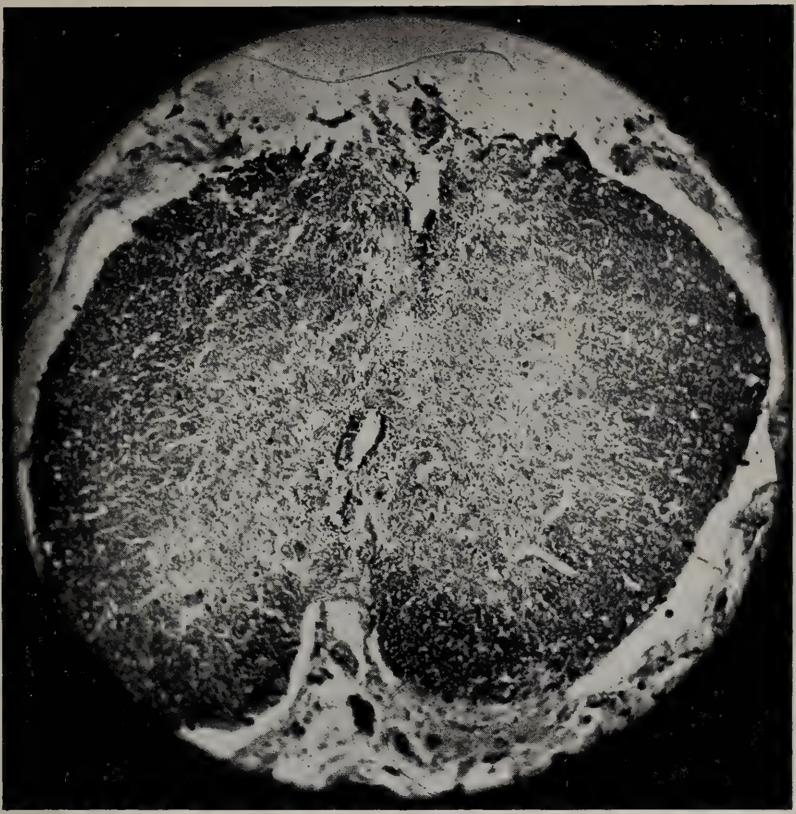


Fig. 1. — Section from lower end of conus medullaris. Danvers Series No. 1624. Woman, aged 60, died of broncho-pneumonia.

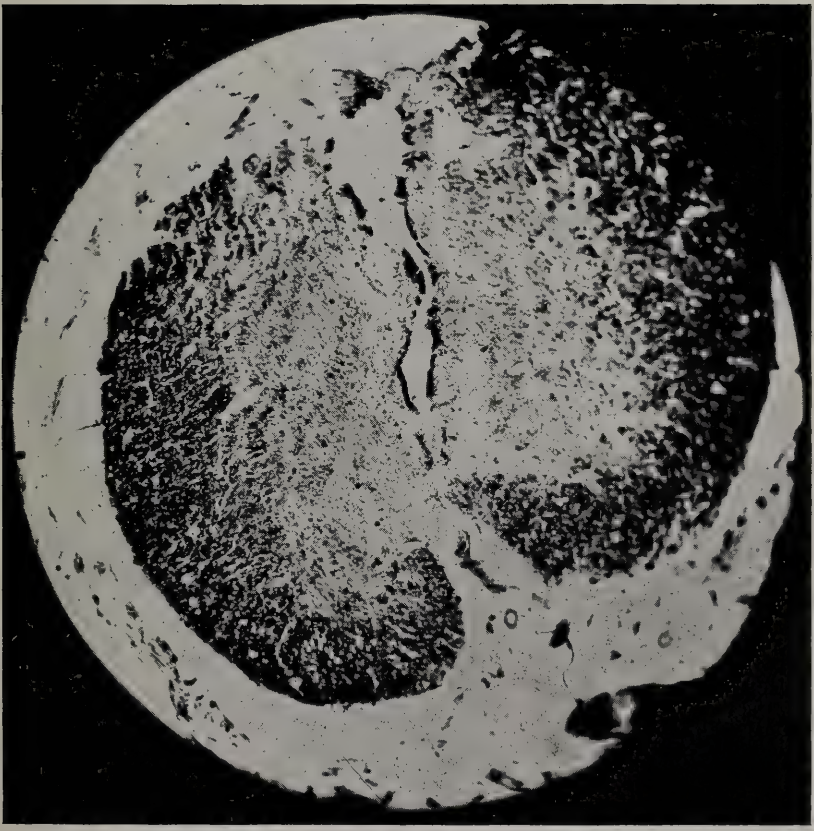


Fig. 2. — Section 200 microns below section shown in Fig. 1. The central canal is opening into the posterior median fissure.

PLATE II.

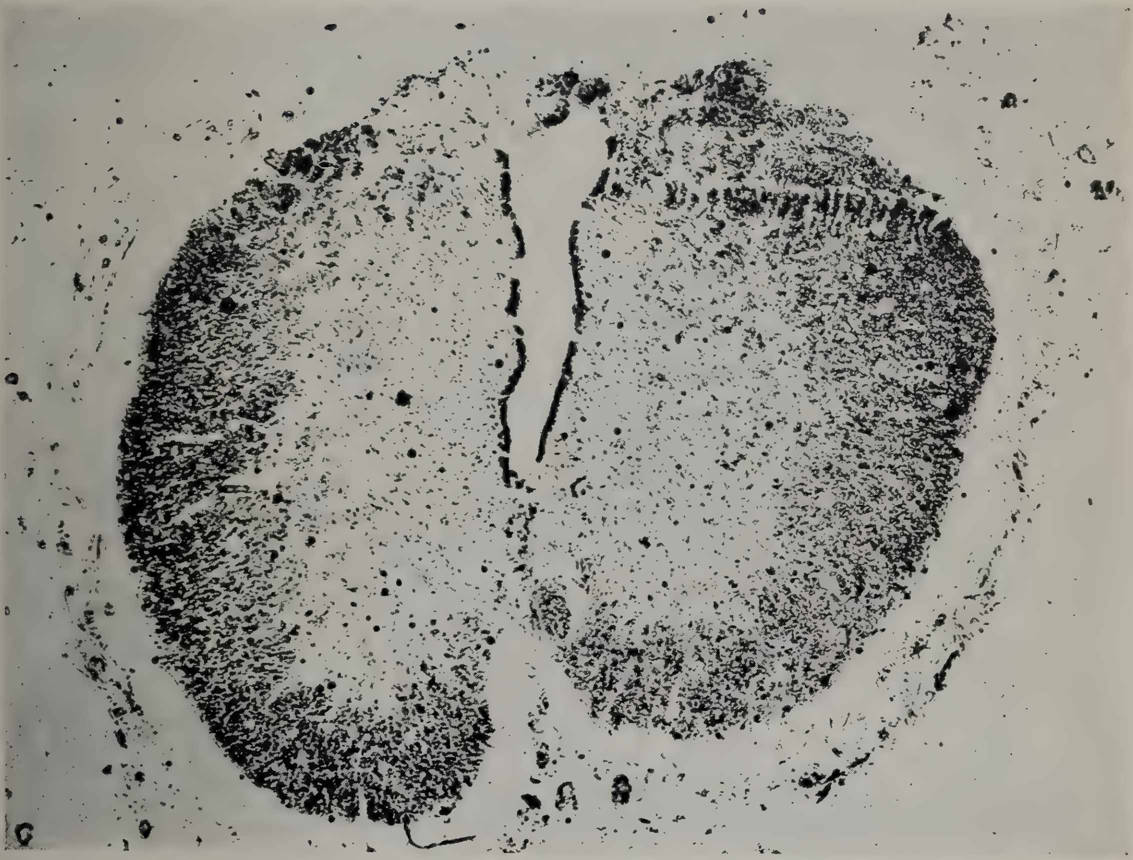


Fig. 3. — Section 200 microns below section shown in Fig. 2. Shows the much dilated canal, at this point partially closed.

PLATE III.

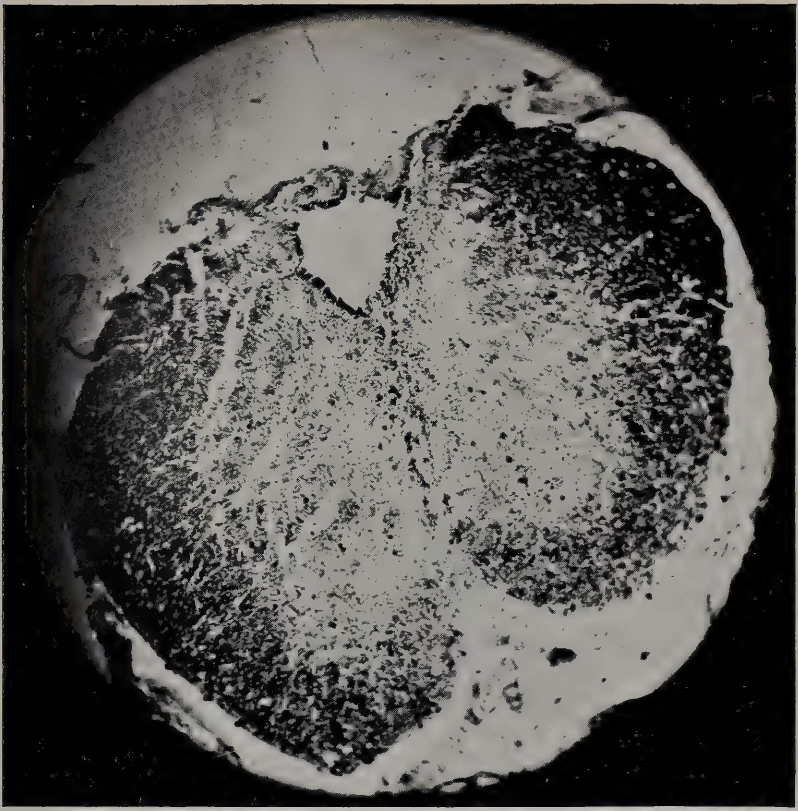


Fig. 4. — Section 400 microns below section shown in Fig. 3. One sees here that the central canal has recovered its posterior wall and continues into the filum as a terminal ventricle.

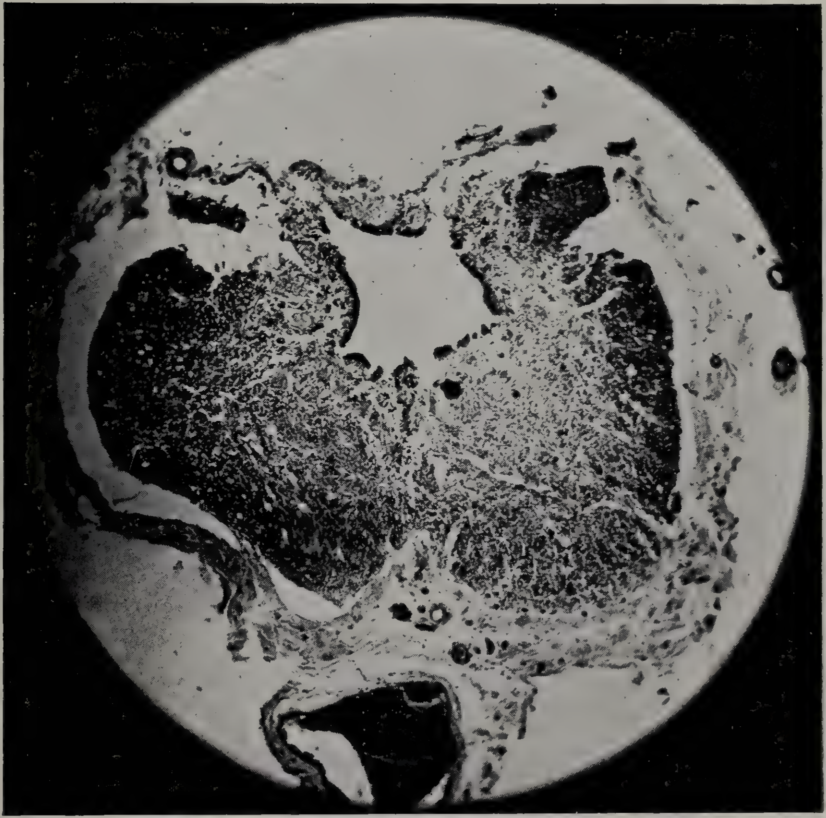


Fig. 5. — Section 2 millimeters below section shown in Fig. 4. The ventricular character of the central canal is well shown.

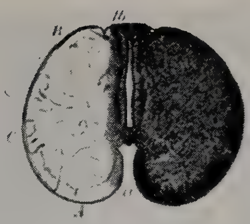


Fig. 23.

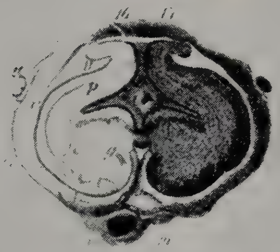


Fig. 24.

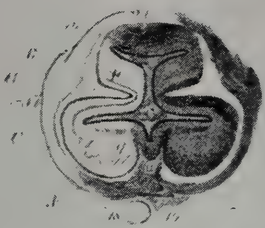


Fig. 25.

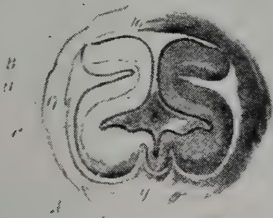


Fig. 26.

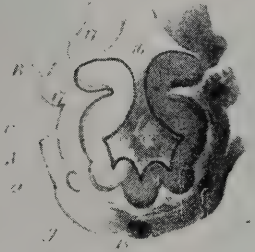


Fig. 27.

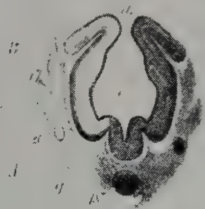


Fig. 28.

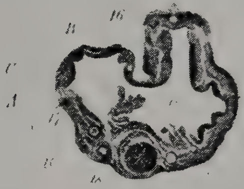


Fig. 29.

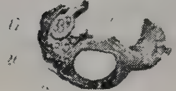


Fig. 30.

Reproduction of figure from Stilling to show the ventricle in the conus medullaris and its communication with the subarachnoid space.

PLATE V.

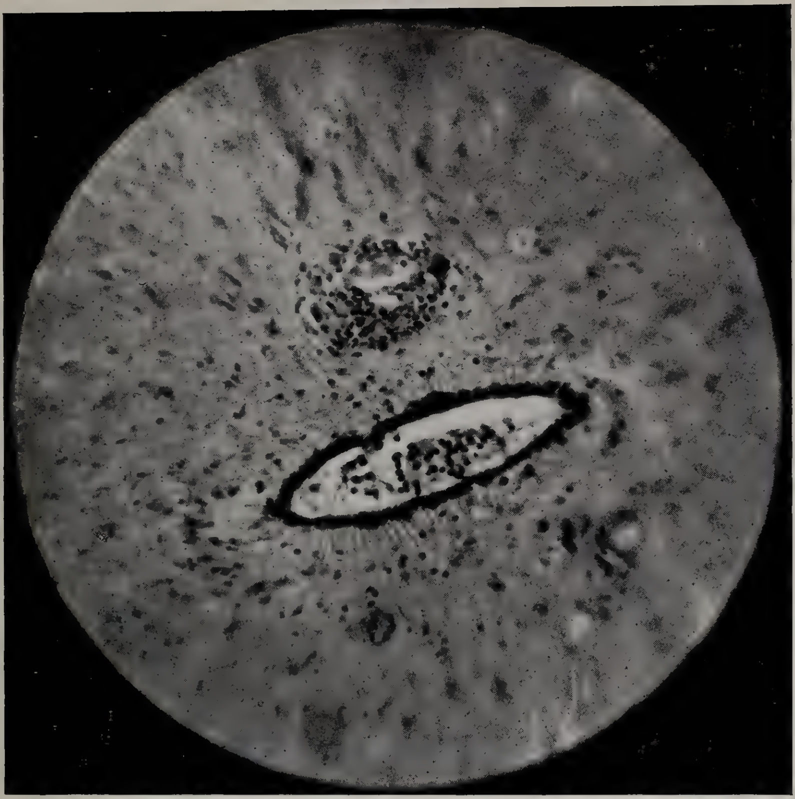


FIG. 6. — Central canal filled with inflammatory exudate. Section from a case of epidemic poliomyelitis in a monkey.

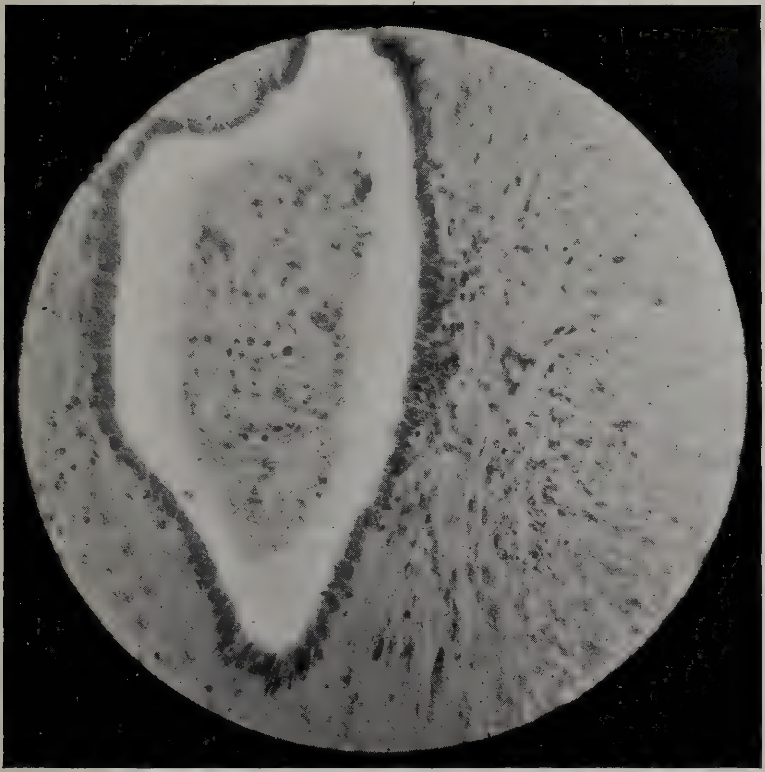


FIG. 7. — Central canal filled with inflammatory exudate. Section from dog injected with dilute HCN (2 per cent.), into subdural space. Dog 11. December, 1911.

PLATE VI.

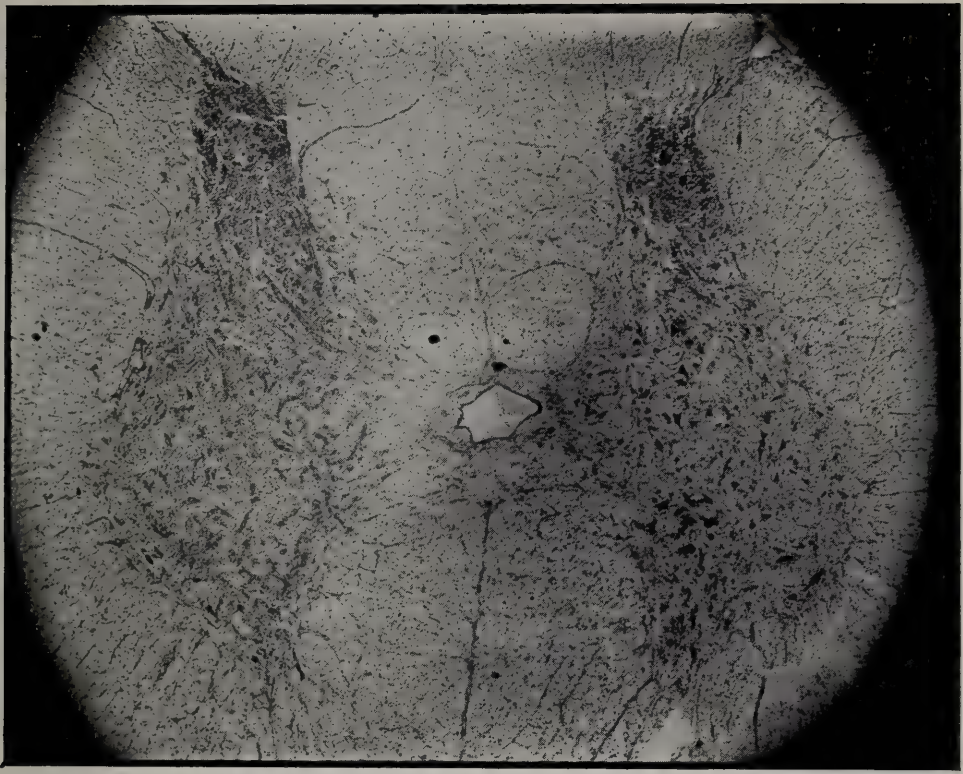


Fig. 8. — Section from spinal cord one week after injection into subdural space of dog of 1 cubic centimeter dilute HCN (2 per cent.), dog weighing 15 kilos. Flaccid paralysis of posterior extremities much more marked on left side. Dog 13. Dec. 19, 1911.

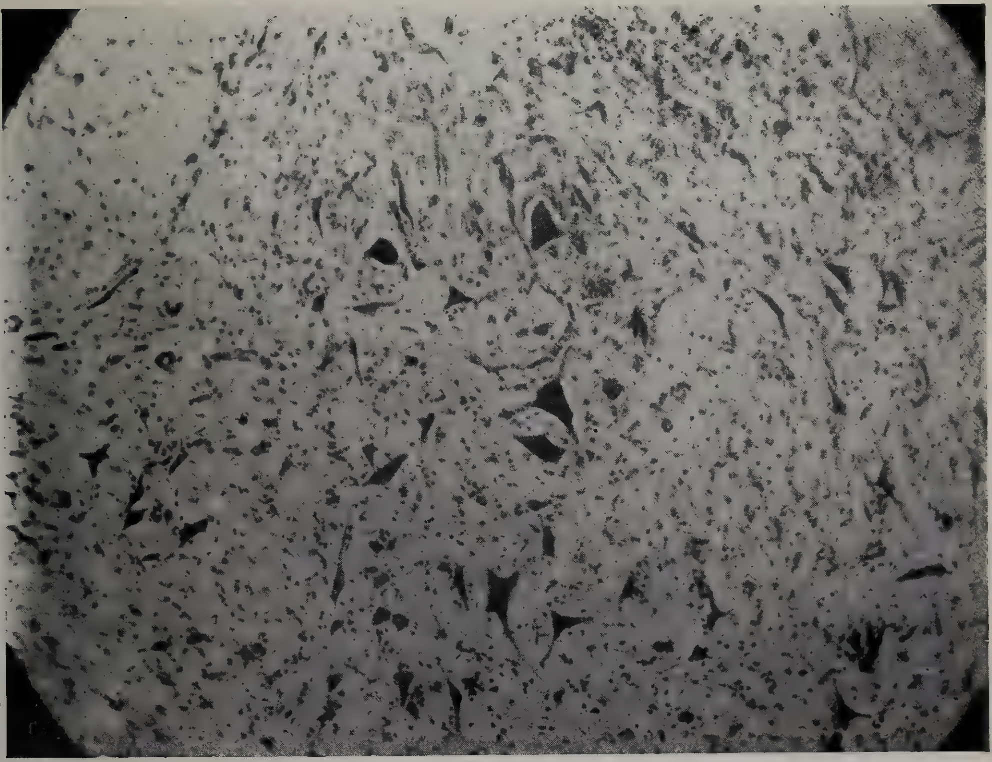


Fig. 9. — Left anterior horn of spinal gray matter of dog. Dog 13. To show inflammatory changes.

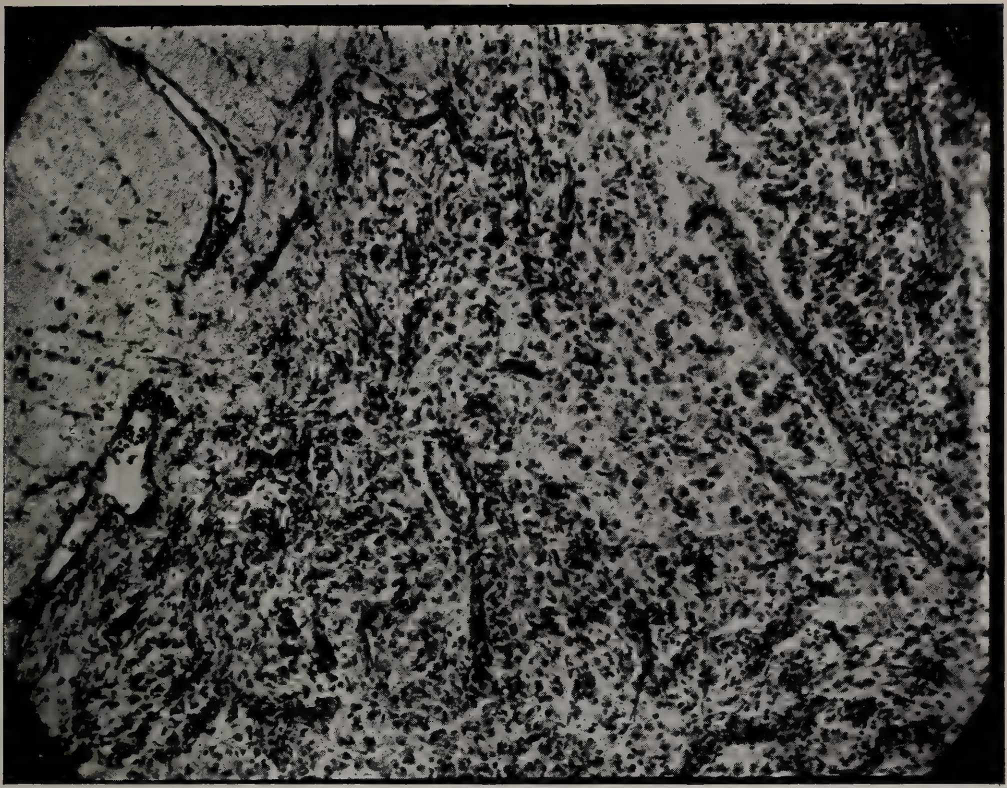


Fig. 10. — Right anterior horn of spinal gray matter from dog, injected with dilute HCN (2 per cent.), into subdural space. Dog 17. December, 1911. Cord removed in twenty-four hours.

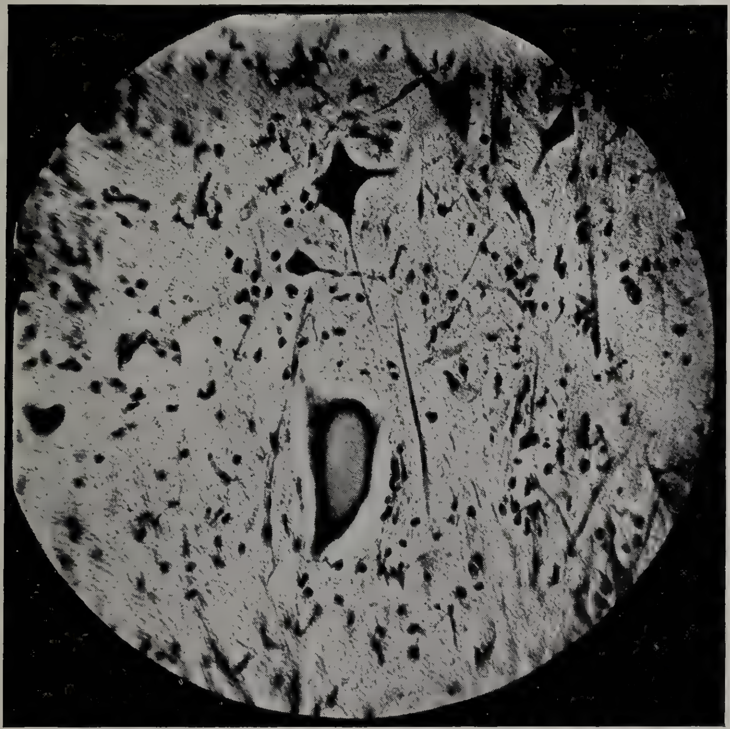


Fig. 11. — Anterior horn cell, showing chromatolysis from spinal cord of dog twenty-four hours after subdural injection of 1 cubic centimeter dilute HCN. Dog 17. December, 1911.

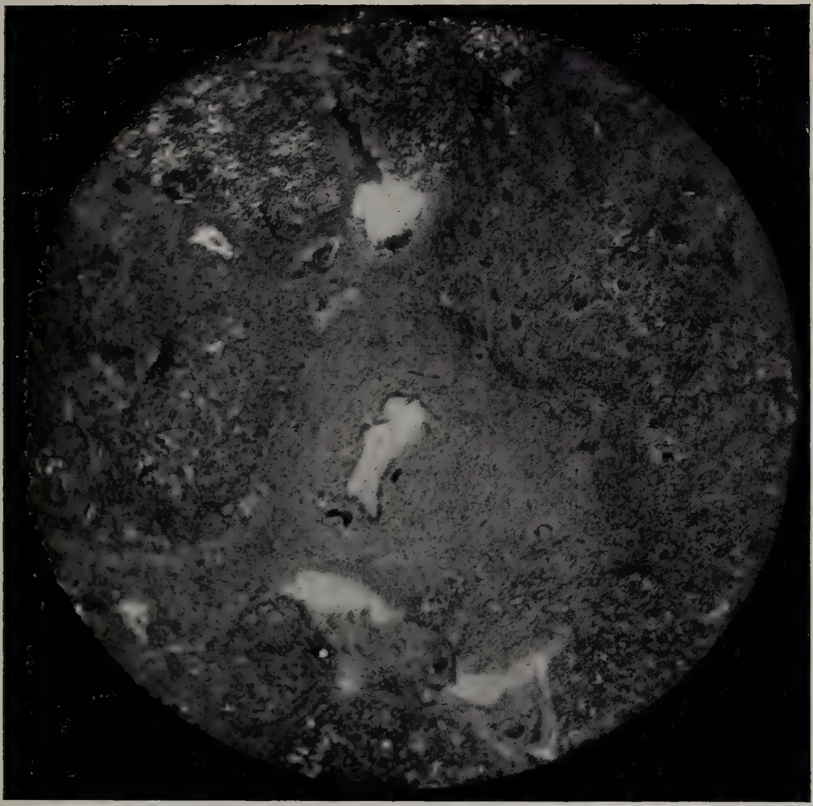


Fig. 12. — Section from dorsal spinal cord from Case 1422, Danvers series, showing gliosis of substantia gelatinosa centralis, the epithelial lining of the central canal still persisting.

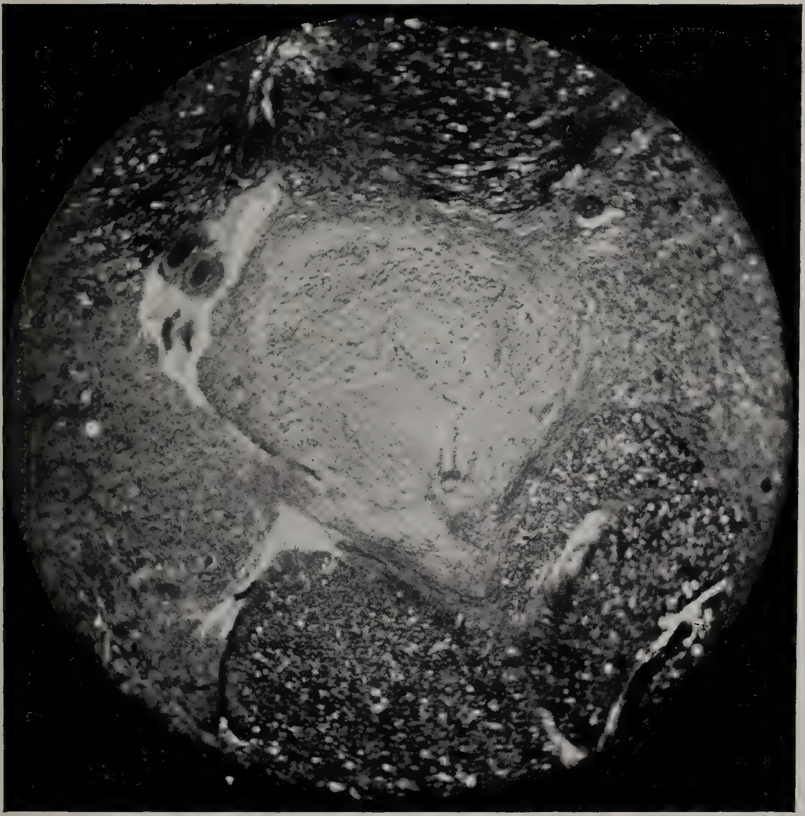
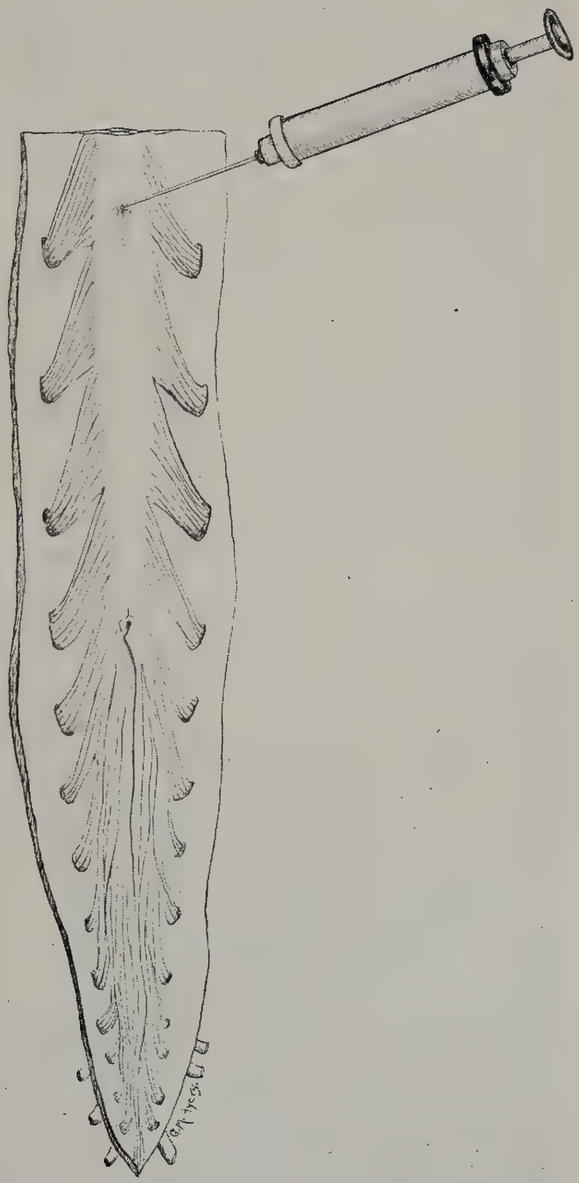


Fig. 13. — Section from lumbar spinal cord of Case 1422, Danvers series. Gliosis about the central canal much more marked, amounting to tumor formation. Part of cell lining of central canal still persisting.

PLATE IX.



Showing the technique of injecting dye into spinal cord of a child, together with a discharge of dye through an opening at lower part of conus (indicated by black spot).

AGE OF PATIENT.	Cases showing Open Central Canal.	AGE OF PATIENT.	Cases showing Open Central Canal.
20 to 30 years, . . .	3	50 to 60 years, . . .	5
30 to 40 years, . . .	2	60 to 70 years, . . .	1
40 to 50 years, . . .	3	70 to 80 years, . . .	1

In my original communication the persistence of the central canal of the cord was offered as an explanation of the occasional paralysis of the respiratory center following the lumbar injection of cocaine for the purpose of anæsthesia. That is, in the presence of an open central canal the drug may be carried up to the fourth ventricle and affect the respiratory and other vital centers. The symptoms of lumbar cocaine (or stovaine) anæsthesia speak for the transmission of the drug throughout the central canal. These patients have a partial motor paralysis, with loss of the sense of pain and temperature. The muscle and tactile senses are not abolished. This disturbance of sensation corresponds to that which is found in syringomyelia, where the lesion is about the central canal. It is here that the cocaine comes in contact with the fibers of pain and temperature sense as they pass upward in the central gray matter. The fibers for tactile and muscle sense do not reach this area and are unaffected by the drug. The cocaine also reaches the motor cells in the anterior horns by diffusion through the gray matter from the central canal.

I have called attention also to the deaths by respiratory failure that occasionally follow the injection of serum containing tricresol into the spinal canal in cases of cerebrospinal meningitis. I demonstrated by experiments on lower animals that this might be due to the carrying upwards of the tricresol, a neural poison, through the central canal to the fourth ventricle.

I have something further to add on the lower opening of the central canal. Sixty years ago Stilling asserted that the central canal opened into the posterior median fissure of the cord in the region of the *conus medullaris*, and that during life the entire canal was filled with cerebrospinal fluid. This statement, as well as Stillings' drawings (Plate IV) showing this opening, was neglected or denied by most anatomists. Independently of this statement I was able to demonstrate this lower opening by a new method in three spinal cords obtained from young children. The method follows: an anilin dye is injected into a cord, in the lower dorsal region for instance, and if, by chance, the central canal is struck by the hypodermic needle the dye will run down the central canal inside the cord and will appear on the outside of the cord in the region of the lower portion of the *conus medullaris* and *filum.* I have here, Plate IX, a drawing of such a spinal cord from an infant, which shows the lower opening very nicely. If, now, that piece of cord which shows the dye on the outside be removed and serial sections be made, the dye will be found staining the central canal and the passage from the central canal to the posterior fissure of the spinal cord. I have here, Figs. 1–5, photomicrographs of sections of one of the cords of the Danvers series, showing how the central canal opens into the posterior median fissure and how the cord closes up again as we go below this opening into the *filum terminale.* These sections of the cord were obtained from an adult aged sixty and are one-fifth millimeter apart. If, now, in a given case such a passage exists, or, what is quite possible, a needle introduced for the purpose of making an injection should injure the *filum terminale* and make an artificial opening into the central canal, we would have a direct channel lined with ciliated epithelium, which might in a few minutes deliver a toxic material, injected into the subdural space, to the fourth ventricle. I think these findings show how it is possible for a poison or an infective agent to reach the meningeal surface of the cord and the central gray matter and leave the rest of the cord unaffected, and how it is possible for disease to spread through the medium of the cerebrospinal fluid upward through the central canal and by diffusion therefrom into the central gray matter. Poliomyelitis is a disease of childhood. An ascending paralysis may also occur in adults, though more rarely than in children. One must recall the fact that this work shows that the central canal was open in more than 7 per cent. of the adults. The percentage in young children is of course much higher, and in the very early years of life is probably 100. In all cases of death from poliomyelitic disease the condition of the central canal of the cord must in the future be investigated. I have been able to examine the cords from 4 cases of this disease in children and found the central canal patent in all of them. It is also not unusual to find the central canal containing acute inflammatory exudate, which also speaks for this method of transmission. I have here photomicrographs of such a case. I wish to add briefly now some very interesting experiments in which it was sought to produce the condition found in acute poliomyelitis by the injection of small doses of dilute 2 per cent. hydrocyanic acid (1 cubic centimeter) into the spinal canal of dogs. On making this injection a motor paralysis of the posterior extremities usually more marked on the left side is produced. Such animals have been kept alive for a varying number of days, the motor paralysis persisting, sensation remaining unaffected. When the cords of these animals are examined, lesions typical of poliomyelitis are found. We have chromatolysis of the anterior horn cells, acute inflammatory exudate throughout the gray matter and in the perivascular lymph spaces, the central canal filled with a like exudate, and a replacement fibrosis in the anterior horns. In fact a pathologist would make a diagnosis from a section of such a cord as acute poliomyelitis.

I wish to show two other sections from the Danvers series which may be of some importance in explaining the pathogenesis of intramedullary cord tumors. These sections are from the cord of case No. 1422, Danvers series. A section of the cervical portion of the cord shows that the central canal in this region is obliterated by a gliosis of the *substantia gelatinosa centralis*.

In the dorsal region, Fig. 12, the same process is seen but the epithelial lining of the canal persists.

In the lumbar region, Fig. 13, this process is more marked, appearing as a small, round neoplasm in the gray commissure, imbedded in which may be seen part of the epithelial lining of the central canal.

THE CONDUCT OF THE INSANE: A CONTRIBUTION TO PSYCHOPATHOLOGICAL THEORY.

By Harold I. Gosline, M.D.,

PATHOLOGIST, WORCESTER STATE HOSPITAL; ASSISTANT IN NEUROPATHOLOGY, HARVARD MEDICAL SCHOOL.

Naturally, it is with a good deal of hesitation that one presents a psychological subject before a meeting of neuropathologists. If my subject may be considered more strictly a psychopathological one, perhaps there is some superficial resemblance. Psycho and neuro — we need make only one fundamental presupposition and that has been made for us long ago. Medical men long ago have supposed that the brain and the mind were inseparable. They will have nothing to do with a transcendental, mystical psyche. But without any reference to affairs which may be considered superficial and academic we will attempt in the few moments which are our portion to introduce a new idea into neuropathology; realizing that the introduction of a concept is often a matter of years rather than of moments.

Men are wont to think of psychology as something too unreal, too intangible; practical men, I might almost say, have given it up for something more profitable. Psychiatrists in general, as practical men, will deny that psychology has much of service to offer them — many will doubtless claim that psychopathology is but a scape-goat brother and possibly it has been made so in some instances.

In charge of legally committed cases, the psychiatrist is the creation of economic and social conditions — the impossibility of caring for the insane by any other means than that of the public funds and the impossibility of depriving an individual of his liberty without legal process. The psychiatrist has to satisfy the law with regard to the patient's insanity. He has to satisfy the friends of the patient as to the necessity of further residence or as to the advisability of discharge, in addition to being prepared for all those other contingencies of illness and accident which the average internist must meet.

From the records which have arisen as a result of these external forces has come a mass of data useful for classification or diagnosis and for prognosis. The psychiatrist is quite justified in his refusal to be interested in the fields of psychology and psychopathology, so unpractical to him. But we would offer it here as a proposition which is not entirely new, that the true position of the mental internist, speaking from one point of view and the position in which he might hope for the greatest progress in the knowledge of mental disease, is as the psychopathologist.

This transfer of the psychiatrist into the psychopathologist occurs whenever the mental internist uses disease concepts divorced from legal and popular concepts, for the purpose of exact scientific thinking. It is this phase of the work of the psychiatrist which is of interest and of value to the neuropathologist and it might even be said is the necessary factor in bringing to a successful issue the efforts of the latter at correlation.

This is the new idea and one which may appear pedantic. But has it never occurred to any one that as psychiatrists we are possibly not studying abnormal variations alone, but something more than that? — trying to adjust the patient to his environment. The more case-histories one studies the more does one become convinced that such is the truth. It becomes apparent that there is no definite psychopathological language but something more — a psychiatric language.

The attempt to build a psychopathological vocabulary is the attempt to form a branch of physiology. If behavior is a function of nervous tissue, and we must suppose that it is, then it is apparent that any variation in behavior must be conditioned by changes in the nervous tissue. The formation of descriptive terms to stand for these variations is the formation of a branch of physiology, or of pathological physiology if such a contradiction in terms may be permitted. It is needless to say that the formation of such a language is not attempted in this paper — but it may be said that an attempt will be made to point out one or two of the possibilities, and it is hoped that some hint may be given of the fundamental value of such studies for the localization of function.

A study was made of approximately 250 cases resident at the Middleton Colony. Their behavior at the present time was summarized from the ward reports of the nurses in charge. The behavior of the same patients at admission was summarized from the card catalogue for such symptoms. (At this point I would say, that I can not praise too highly the wise foresight of the superintendent, in continuing this card index. The system might be extended to other hospitals with advantage.) If we had gone on farther our search would be rewarded. It was found that the words used by both doctors and nurses fell quite naturally into two main groups — the group of the strong and that of the weak. This distinction between words has long been made by rhetoricians but the practical bearing of the distinction is not so apparent until we realize that words may be made to exactly express the condition of our patients. But this was not all that became evident by our simple comparison of the terms used at admission and at the present time. The words used at both times, that is, by both doctors and nurses, were almost without exception those of purely objective description. Words coined by nurses were purely of objective description, — some contain a personal element, — while those coined by physicians frequently contain a deal of interpretation.

Of the terms used at admission some have been dropped almost entirely at the present day. Bulimia has been replaced by abnormal appetite, sicchasia and sitiophobia by refusal of food; these have also been called mental anorexia.[1] The point is, patients do not eat, — to say that they abhor food (sitiophobia) is perhaps saying too much; it is at least combining an interpretation in an observation, — it is making a diagnosis in stating a symptom. Disgust for food (sicchasia) is no better, of course, and refusal of food, the ordinary term of to-day, introduces an element of will into the patient's reaction which is not known to exist there.

Abulia has merely been replaced by its synonym, — loss or defect of will, — and is commonly used as a point in diagnosis. The motor phenomena which give rise to this term are equally well described by loss or defect of attention which has the added advantage of reducing said motor phenomena to something tangible which can be observed by the method of introspection and resolved into elements which are kinesthetic in origin. No one will deny that it is motor phenomena which have given rise to the confusion in terms here pointed out and psychopathology will render a service to neuropathology in insisting on this point and that search be made first in the motor regions or on the other side of the reflex mechanism, in the kinesthetic regions. In making his searches in these regions the neuropathologist should bear in mind Bastian's ideas of the distribution of the motor and kinesthetic areas.[2]

Certain other terms seem to have been used with a sense of doubt on the part of the observers. On the other hand terms have been used with the greatest confidence as to their significance but with no fundamental understanding of their meaning and no uniform method of application. In this connection I will never forget a personal experience in trying to define "psychomotor excitement."

The terms used now are those used by nurses on the wards. They represent what may be called the first degree of observation since they are devoid, necessarily for the most part, of all interpretation. The word "confused," used once by a nurse, was the only departure from the rule. They approach more nearly the ideal of a pure objective description, — are nearer being a description of conduct and hence are more adaptable for clinico-pathological correlations. Naturally, it is unnecessary to adopt all the naiveté (spits, drools, shouts, sings) of the descriptions at times produced just as it is necessary to eliminate the element of personal feeling (abusive, disagreeable, dull, etc.).

The terms used both at entrance (by physicians) and now (by nurses) are, with single exceptions to be named later, those of the first order of observation, that is to say, terms of objective value without interpretation. They are the most stable and carry the picture well. They are denudative, destructive, excited, irritable, manneristic, masturbating, self-mutilating, negativistic, noisy, obscene, profane, resistive, untidy, violent, vomiting, incoherent. Strangely enough the term "incoherent" seems correctly applied by all in spite of the fact that many observers could not define its opposite or far less enumerate the factors necessary to the attainment of its opposite.

The few terms of interpretation used both at admissions and now are depressed, drowsy, stupid, all of which apply to reactions characterized by little motor display.

Delusions and hallucinations can never be objective, since their determination depends on the patient's statement though they may be taken practically to be so.

There are certain terms of the first degree of observation which are probably unknown to our nurses, which would account for their non-appearance now. They are "euphoria" and "expansiveness" shown in the patient's speech productions, and "elation" and "exaltation" shown in the motor activities expressed in manner, dress, etc., in addition to the speech.

That a correlation between clinical symptoms and brain findings which is fairly direct does exist here has recently been pointed out.[3] I have purposely modified the statement by the words "fairly direct" for the reason that the correlation is not so much between the words "euphoria", etc., and the brain condition, as it is between the lack of contact with the outer world of conditions, and the physical state of the brain. As pointed out in that remarkable paper referred to, the patient talks of millions when he is penniless, he is an athlete when it is apparent that he cannot move because of general paresis of all the movements, in other words he is entirely out of touch with the reality and to correspond we have the expected, that the brains of paretics with such a clinical picture show the grossest and most extensive lesions.

It is apparent then that in this case we must go beneath the words and actions of the patient in making our correlations. If this finding in paresis — the divorce of the patient from contact with the real — is found to be of more general application, we have at least one practical, tangible direction of research discovered already for psychopathology, that is to say, the comparison of the phantasies of the patient with his actual condition, taking the discrepancy as an index of the amount of damage done to his brain.*

A comparison of patients in this series, where nothing more was possible than the comparison of their present condition with their condition at admission, showed that of those with elated, expansive, exalted and euphoric tendencies (41 cases) 12 per cent. now show no reaction, while the remainder show a weakened reaction.

Disturbances of memory occur with fair frequency. They are exceeded only by the various forms of disorientation, delusions and hallucinations and occur in 76 of the 251 cases. The field of the amnesias has been but little worked and that only in connection with the aphasias. It has been found that there is a memory for words as they are heard and as they are seen together with a memory of the kinesthetic impressions aroused in the pronunciation of words. These have been fairly narrowly localized.[5, 6, 7] But in the case of the frank psychoses we make no note for the most part as to the definite memory involved — we merely write "partial" or "complete amnesia."

The duration of the psychosis was from about one year (1 case) to sixty-seven years (1 case), the psychiatric diagnoses dementia præcox and allied (138 cases), manic depressive and allied (18 cases), senile and allied (45 cases), general paralysis and allied (7 cases), alcoholic psychoses (14 cases), imbeciles and allied (22 cases), epileptic dementia (1 case), Huntington's chorea (1 case), hysteria (2 cases), unclassified (3 cases). The symptoms which form the basis for this study were selected and studied without regard to psychiatric diagnosis. The relation of the present condition of the patient to the duration of the disease showed that there was a tendency to a type reaction of a weak sort whether the disease ran sixteen, seventeen, nineteen or thirty-seven years when studied specifically for those who were destructive at admission. This finding was general for the duration of psychosis, though not for every symptom.

This comparison affords us an example not unlike those appearing in general systemic and infectious diseases where the duration of the disease may have little to do with the ultimate result, though the result may be more or less similar over a series of cases.

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* This lack of correspondence between the ideas of the patient, as expressed in his talk and his real condition, has been considered by some workers as a phenomenon, explainable on psychological grounds.[4] If the phenomenon is explainable in this way, it may be fitting to ask why of the 41 cases in this series not one showed the same symptoms after a period of four to fifty-seven years, but all had arrived at a state of mild excitement characterized by irritability, restlessness and noisiness?

Twelve who were destructive at the beginning of the psychosis were compared. Three had run a course of sixteen years and were irritable and excited; 2 were noisy; 1 violent; 1 talkative, profane, restless and aggressive; 1 untidy, depressed, negativistic and masturbated. Of 2 cases with a course of seventeen years, 1 conformed to routine, that is to say, there was no report; 1 showed a weak reaction, was excited, noisy, resistive, profane, irritable, talkative, restless and untidy. Three had a course of nineteen years, — all are aggressive; 2 are violent; all for the most part are in the weakly reacting class. Two had a course of thirty years, — 1 is destructive (had a shock recently); both have a weak reaction. Two had a course of thirty-seven years, — 1 now has no reaction; 1 a strong to weak reaction, is aggressive and violent, but also noisy, irritable, talkative and restless.

More exact and perhaps more interesting would be a comparison of patients of the same age, with the same symptoms at the beginning and the same duration without known heredity or with similar heredity as far as such is possible.

The condition of the patients as shown by individual symptoms was next found to differ now from their condition at admission.

Of 20 cases which are now destructive, — duration thirty-one years, — 1 was depressed, apathetic, indifferent, hallucinated at admission; 1 jealous, violent and restless. Opposite or dissimilar conditions at entrance may show the same condition in time.

A comparison of the present state of patients showing dissimilar states at admission shows that the active patients are now rather the less active ones — a result not exactly to be expected from the picture at admission.

Comparing those who were confused with those who were destructive, we find that the present state is similar, that is, a weak reaction exists, but in the latter there is a higher percentage showing drowsiness, stupidity and untidiness now, — not corresponding with the duration of the disease and the age of the patient, — while the percentage showing no reaction or the reaction of conformation is the same in each, 25 per cent. (The cases are different.) We have a weak reaction (pale, colorless words) as the general tone in spite of occasional more active demonstrations and there is a tendency to signs of deterioration shown more in those who were destructive at the start. What little we know in general of confusion and destructiveness might have led us to expect quite a different outcome, since in general people who are confused are commonly thought to be "worse off" individually than those who are destructive, though perhaps the latter are more dangerous to the community.

Frequently the symptoms at admission are found to be absent now. We seldom find the symptom of admission carried down to the present.

Of 29 cases which were destructive at admission only 3 are destructive now; of 72 cases which were irritable at admission only 30 are now irritable, although there are now 126 cases showing irritablity. Of 24 cases showing mannerisms at admission, only 1 is still manneristic. Of 12 cases of negativism, only 1 is now negativistic; 41 others have developed this symptom, making a total of 42 who now show it. There were 22 cases obscene at admission, — none of them are now obscene. Only 3 cases were profane, — 1 is still profane and there are 47 others who are now profane. Forty-four were resistive at admission; of these, 9 are now resistive. There are 61 resistive patients now, making 52 new cases which have developed the symptom and 35 patients from whom it has disappeared. Fifty-nine cases were restless at admission; 32 are restless now, while 11 have completely deteriorated. At present 121 patients are restless, making 16 of the original 59 cases which are not restless though they are still reacting and 89 who have become restless since admission and are now restless. Of 9 cases untidy at admission, 1 is untidy now while 36 others have become so, and this is not related to their age in many cases. Of 64 violent cases at admission, 7 are still violent at times and 57 cases have ceased to be violent; and of the 57 cases, 11 do not react at all. Thirty cases are now violent, making 23 new cases to become violent since admission. (See Table I.)

From the above data we may rightly draw the following conclusions: that there is a tendency to an increase in irritability, negativism, profanity, resistiveness, untidiness and the state of absolute subjection to routine while violence decreases and obscenity dies out. Resistiveness shows a smaller increase than irritability. Restlessness and irritability persist from admission to the present time in more cases than any other symptoms.

Let us rest content to state the facts without theorizing as to causes. But if words may be taken as an accurate representation of the condition of our patients, these words show that there is a change in our patients — and all these words are objective with the exception of "depressed" which is at times used improperly.*

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* A patient was admitted to this hospital on a certificate which stated that the patient had become depressed for no apparent reason and had refused to speak for two weeks. (Note the "will" element in "refused to speak"). She was found to be aphasic and hemiplegic with a positive blood and spinal fluid. Later she recovered her speech and the use of her limbs to a moderate degree. An objective statement would have been accurate. An "interpretative" statement was in this case proven to be entirely erroneous.

No one may doubt that words can accurately represent the condition of our patients but it is another phase of thought which wills to present this fact acutely and objectively. It is certainly unjustifiable to rest forever content with impressions merely.

We next studied the frequency of occurrence of what may be considered the major symptoms at entrance. While not purely objective, except in a few instances, these terms do not carry interpretation and are applied by means of fairly objective tests. It was found that amnesia and disorientation occur with almost equal frequency, while apprehensiveness and indifference occur with equal frequency although they occur about half as often as the first two symptoms. Insomnia, seclusiveness and suicide go together, as do muteness and apathy, and euphoria, exaltation and expansiveness. In the order mentioned these five groups occur in the relation 8:4:3:2:1.

During the past decade a large amount of work has been done pointing to correlations of these "major symptoms" with actual brain conditions. That the work was done mainly in connection with gross and histological studies of the nervous system will explain why it was impossible at the time to take up the work of correlation more systematically. The first labor to be accomplished was to prove the anatomical basis of the psychoses. Correlations would follow. The pioneer work was done by Southard and his co-workers. To show some of the possibilities we will mention the work in which three cases of melancholia with delusions of negation were shown to have "nerve cell pigmentation constantly found in the elements of moderate size in all parts of the cortex examined."[8] Later (1913) it was pointed out that melancholia cases are delusional — the correlation with pigment finding was left to the future.[9] In somatic delusions a "peripheral element" was discovered in somatic disease, or in the "sensory path of centripetal impulses" or "back of the Rolandic fissure in the sensory-elaborative areas."[10] Later it was demonstrated that the characteristic delusions of general paresis are autopsychic in nature and a correlation suggested between them and frontal lobe lesions.[11] Certain symptoms were conveniently grouped as hyperkinetic and an association pointed out between them and partial lesions of the optic thalamus.[12] In the neuropathological work on dementia præcox by the same worker as early as 1910, frontal-paranoid, cerebellar-katatonic and post-central-superior parietal to katatonic relations are pointed out.[13] Later auditory hallucinosis was correlated with temporal lobe lesions; katatonia and hallucinosis were discovered to be related to internal hydrocephalus, and a certain non-frontal group of delusions grouped "provisionally under the term hyperphantasia" were found to have a correlation with posterior association centers.[14] Alzheimer, quoted in the above,[14] had sketched infrastellate correlations for katatonia which were later changed to suprastellate ones. More striking still, perhaps, is the correlation in a case showing "striking scenic visual hallucinations" and "satellitosis of the common occipital cortex" — visuo-psychic tissues.[15]

In order to reduce the facts cited through the body of this paper to a uniform basis a mathematical method was used. By so reducing all terms to a common basis the comparative value of terms used at admission might be determined for the prediction of the outcome of the disease or vice versa in picturing the past of the disease.

The number of cases showing a given symptom at admission minus the number which had completely deteriorated was used as denominator and the number of cases now reacting in a certain way was used as numerator in the following manner: there were 38 patients confused at admission, 8 have deteriorated, subtract to give the number of patients reacting in some way or other now. This number, 30, is the denominator.

It is found that 20 of these 30 reacting patients do so by being restless; 20 are restless; 20 is the numerator; $^{20}/_{30}$ of patients who were confused at admission and are still reacting are restless. This was done for each symptom, and a comparison made between symptoms at admission and now, and between symptoms now and at admission. The comparison was made possible by reducing the fractions so obtained to the decimal system whereby numbers are gained which are functions of symptoms and which make the frequency of occurrence of the symptoms comparable but which are purely substitutes for other means of description.

It is possible to make evidence graphically by means of curves or co-ordinates that those who are violent now were at admission disoriented, incoherent, amnesic, depressed and irritable. Those noisy now were irritable, violent and restless, incoherent, amnesic and depressed with equal frequency and somewhat more frequently were disoriented.

Irritability, restlessness, noisiness and other moderate reactions did not play so large a role at admission as they do now. The reaction then was strong whether demonstrated actively or not by outward signs; the reaction now is weak or there is no reaction at all notable by the nurses, — the patient goes on day by day like an automaton. This has long been felt but perhaps not often presented in tangible form.

Those who are destructive or euphoric pass with equal frequency into a state of mild irritability, restlessness, noisiness and talkativeness, though from the terms destructive and euphoric and the attitudes presented by the patients corresponding to these terms one might expect quite different results. (See Tables II and III.)

It has been said that 13 to 15 per cent. with mental anorexia die[1] (page 434).

Of more general impressionistic value is the feeling that the untidy are those with arteriosclerosis or organic brain disease more often, and why should the untidiness of dementia præcox, for instance, be considered less lightly as a sign of brain disease, why, of all things, should it be ascribed to a disordered will? The fact that preseniles live longer than seniles appeals to me as a reason why certain symptoms should be considered to have greater significance than others and thus in a way to represent the state of the patient's brain.

In spite of the weakness of our present state of knowledge of the subject of correlations, I would present this paper not as a total argument but as a plea for the continuation of the proper use of words and scientific observations which has been started for memory of the various sorts and for the major groups of psychiatric symptoms.

It seems important that words used to represent the condition of the patient should be accurately chosen. While not necessary to psychiatry as a means of adjusting patient and friends to the changed conditions caused by the patient's removal from the community, it appears that such accuracy is highly desirable and necessary in order to make possible the correlations between the clinical and the pathological material which is the task of the future for the neuropathologist.

It is the personal belief of the writer that such correlations may be made between the clinical symptoms themselves and the anatomical material, and that psychiatry and psychiatric diagnoses are something else again. If we were to agree with Arnaud,[16] we might hesitate at once to make psychiatric correlations.

Whether this accuracy in crystallizing clinical symptoms into words is to be accomplished by introducing a new curriculum into some of our schools, or by courses of instruction to enable our nurses accurately to describe the patients, is for the interested to decide. As necessary to the insane hospital as the temperature chart to the fever hospital is some method of recording the behavior of the patients; and last, but not least, we need in the clinical staff of some of our hospitals more zeal for accurate scientific work that will make the future labors of the neuropathologist big with results, both for science and for practice.

CONCLUSIONS.

1. That the reactions of patients fall into two groups, the group of the strong and that of the weak.

2. That the words used to describe patients may be divided into three groups, those of the purely objective symptoms or of what may be called the first degree of observation; second, those which have some interpretative value or what may be called the second degree of observation; and thirdly those other major psychiatric symptoms which are not objective, but which are discovered by fairly objective tests and which certainly are not interpretative.

3. That the objective symptoms of the first and third groups are of greater value from the psychopathological viewpoint and for making clinical pathological correlations.

4. That the major psychiatric symptoms do occur in definite relationships. Correlations have already been carried out between these and the brain condition.

5. That there is some evidence to show that the discrepancy between reality and the phantasies of the patient may be taken as an index of brain change in certain cases.

6. That the condition of patients at admission was different from what it is now in most cases.

7. That moderate reactions did not play so large a part at admission as they do now.

8. That there is a tendency to a type reaction of a weak sort independent of the duration of the disease.

9. That patients who were the more active at admission are now rather the less active ones.

10. That the mildest reactions are in general the ones that persist most frequently from admission to the present time.

11. That psychiatry and psychopathology are two different branches of one science.

12. That psychopathology is necessary for the work of the neuropathologist in the making of clinical pathological correlations.

TABLE I.

	Admission.	No Report now.	Number who show Same Symptom now and at Admission.	Now.	Lost Symptom.	Gained Symptom.	Still reacting but not with Original Symptom.
Denudative,	6	1	–	8	6	8	5
Destructive,	29	3	3	13	26	10	23
Incoherent,	57	13	–	2	57	2	44
Irritable,	72	17	30	126	42	96	25
Manneristic,	24	2	1	2	23	1	21
Masturbating,	4	1	1	3	3	2	2
Negativistic,	12	2	1	42	11	41	9
Noisy,	1	–	1	95	–	94	–
Obscene,	22	2	–	1	22	–	20
Profane,	3	1	1	48	2	47	1
Resistive,	44	7	9	61	35	52	28
Restless,	59	11	32	121	27	89	16
Untidy,	9	2	1	37	8	36	6
Violent,	64	11	7	30	57	23	46

TABLE II. — *Symptoms of Admission reduced to 100.*

	Restless.	Noisy.	Aggressive.	Violent.	Irritable.	Talkative.	Profane.	Resistive.	Negativistic.	Destructive.	Denudative.	Depressed.	Drowsy.	Untidy.
Confused,	.666	.400	.366	.200	.666	.200	.233	.233	.200	–	.033	.133	.066	.200
Denudative,	1.000	.600	.400	.200	.600	.400	–	.200	–	.400	–	.200	.400	.400
Destructive,	.615	.615	.346	.230	.730	.307	.384	.307	.190	.115	–	.115	.076	.269
Expansive,	.444	.555	.444	.222	.666	.444	.444	.222	.111	–	–	–	.111	.111
Exalted,	.470	.470	.352	.176	.704	.235	.235	.058	.117	.058	.058	–	.235	.235
Euphoric,	.571	.428	.142	.071	.785	.357	.357	.142	–	.071	–	.142	.214	.142
Incoherent,	.613	.590	.204	.227	.545	.408	.250	.318	.113	.090	.022	.090	.090	.159
Irritable,	.563	.400	.254	.181	.543	.271	.271	.309	.236	.090	.072	.127	.090	.200
Manneristic,	.500	.500	.181	.136	.636	.227	.090	.454	–	.090	–	.045	.045	.362
Negativistic,	.500	.400	.300	.300	.700	.300	.100	.200	.100	.200	–	.300	.100	.400
Obscene,	.600	.650	.200	.100	.650	.400	.450	.250	.100	.100	–	.050	.250	.050
Resistive,	.648	.540	.270	.189	.594	.432	.378	.243	.162	.081	.027	–	.135	.187
Restless,	.666	.500	.291	.166	.604	.291	.166	.229	.229	.083	–	.104	.041	.187
Untidy,	.857	.285	–	–	.285	.142	–	.428	.428	–	.142	.142	–	.142
Violent,	.603	.528	.320	.132	.566	.283	.339	.283	.132	.056	.037	.037	.094	.188

TABLE III. — *Symptoms of the Present reduced to 100.*

	Irritable.	Violent.	Insomnia.	Resistive.	Exalted.	Homicidal.	Suicidal.	Restless.	Negativistic.	Destructive.	Euphoric.	Obscene.	Expansive.	Apprehensive.	Denudative.	Aggressive.	Mute.	Indifferent.	Disoriented.	Incoherent.	Amnesic.	Untidy.	Seclusive.	Depressed.
Denudative, . .	.500	.250	.125	.125	.125	.125	–	–	–	–	–	–	–	–	–	–	.250	.250	.275	.125	.250	.125	.125	–
Destructive, . .	.384	.230	.154	.230	.077	.077	.154	.307	.154	.230	.077	.154	–	–	.154	–	.230	.307	–	.307	–	–	.307	.154
Irritable, .	.238	.238	.127	.182	.095	.095	.095	.238	.055	.150	.087	.103	.047	.174	.024	–	.079	.198	.301	.198	.293	–	.119	.230
Negativistic, . .	.309	.166	.095	.143	.048	.143	.071	.262	.024	.119	–	.048	.024	.238	–	–	.119	.238	.380	.119	.285	.071	.119	.309
Noisy, . .	.242	.294	.115	.052	.084	.105	.115	.273	.031	.147	.052	.137—	.052	.168	.021	.010	.084	.147	.337—	.252	.294	.021	.137	.200
Profane, .	.312	.375	.166	.312	.083	.146	.104	.187	.021—	.187	.104	.187	.083	.187	–	–	.083	.146	.291	.229	.333	–	.104	.187
Resistive, .	.279	.246	.099	.147	.016	.131	.049	.180	.033—	.115—	.033—	.072	.033—	.180	.016	–	.115	.230	.393	.230	.377	.049	.180	.180
Restless, .	.256	.264	.091	.198	.066	.115+	.132	.272	.049	.132	.066	.099	.033	.140	.041	–	.091	.182	.339—	.223	.239	.049	.140	.198
Untidy, . .	.299	.270	.108	.324	.108	.135	.108	.270	.108	.189	.054	.027	.027	.162	.054	–	.270	.216	.380	.189	.189	.027	.081	.135
Violent, . .	.333	.233	.133	.266	.100	.233	.200	.266	.100	.233	.033	.066	.066	.166	–	–	.133	.133	.399	.333	.333	.033	.166	.366

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THE BROADENING FIELD OF MENTAL MEDICINE.

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It is proposed in this paper to discuss the present field for psychiatry and the attempt to indicate what greater opportunities the near future seems to hold in store.

First, however, let us contrast the conditions generally found a few years ago, but now rapidly disappearing from view. Less than two decades have passed since the practice of psychiatry was almost exclusively limited to the hospital for the insane, or asylum as it was almost universally termed. Psychiatry was separate and a thing apart from general medicine. There were several factors which produced this divorcement: first, the isolation of the hospital, — usually built 7 miles from nowhere, and consequently difficult of access and effectually removed from social and medical centers and general hospitals; second, the general attitude held toward psychiatry and mental disease by both the medical profession and the public, which combined apathy or antipathy, ignorance and superstition. In the medical schools there was very little psychiatry taught, and very often none at all. Small wonder, then, that few young physicians were attracted toward it as a specialty, and that those who were came often poorly prepared, or attracted merely by salary and free maintenance as a stepping stone to other branches of medicine. Some, however, were inspired by a sincere effort to live up to high ideals of medicine, with hopes of successful research and new discovery. To the latter group let us pay our respects and pause a moment to see what happened irrespective of motive in the majority of instances. Once on the asylum staff the process of divorcement from general medicine and its stimulating interests began, and quickly settled into humdrum routine. In a year or two the young psychiatrist became thoroughly institutionalized with anchylosis of initiative and stasis of medical advancement, — a life member of the institutional lotophagi. It is interesting to note the development of a definite institutional type among asylum physicians, the product of the old-time routine and lack of sufficient outside interests, as well as the reaction of the generally hopeless and helpless feeling that nothing could be done for the majority of patients.

But fortunately for both patient and physician there has been a psychiatric renaissance. After many dormant years this country at last awoke to the advantages of the European psychiatric clinic in close touch with the university and general hospital, and we note the establishment of the Psychopathic Hospital at Ann Arbor, Pavilion F of the Albany Hospital, the Boston Psychopathic Hospital and the Phipps Psychiatric Clinic, all within a decade. It is difficult to realize what a great advance all this represents, so rapid has been the march of events. With new ideas and new hopes, asylums became hospitals, physical restraint began to disappear and the application of individual treatment as for any other sick patient was inaugurated. With diversional occupation in great variety and a general employment of a large majority of patients, life in a hospital took on new interest for patient, nurse and physician and gave far better results in recoveries and improvements. The establishment of clinical and pathological laboratories meant greater accuracy in diagnosis, better study of cases and a more rational and effective therapy, and medical school, general hospital and mental hospital were brought closer together.

The psychopathic clinic in proximity and co-operation with the medical school and general hospital has stimulated and facilitated the teaching of psychiatry, and is greatly increasing the number of medical students who choose it as a career. The psychopathic clinic, easy of access with voluntary admittance, has also done much to dissipate popular superstition and misconception concerning mental disease. But the psychiatric renaissance has reached out beyond the institution and here its field broadens.

It is now about ten years ago since the first organized effort to supervise and assist discharged or paroled mental cases was made in New York. The value of after-care was at first slow to be appreciated, but of late it has gained an impetus in Massachusetts, New York and Maryland that will give it widespread application. The hospital residence of an average case is hardly more than a biographical cross section of the life history of the patient, and no longer is it good practice or good policy to neglect what has gone on before, or to withdraw our interest and assistance as soon as the patient steps out over the hospital threshold. Organized first as a private charity, the State of New York several years ago took over the after-care work that had been begun in 1906, and it is now a regular part of the hospital routine. In the past year New York and Massachusetts State hospitals have greatly increased their sphere of usefulness by inaugurating dispensary clinics for mental and nervous cases, held sometimes at the institution but often in some city within the hospital district. This innovation, added to the placing out and after-care service, marks a new epoch in psychiatry that will prove to be also an important factor in prevention, and will bring the hospital still closer to the public.

The great modern trend of medicine toward prevention has been shared in prominently by psychiatry, with large forces actively working in this direction. In addition to the State hospitals and the newer ramifications above referred to should be mentioned the social service departments of psychopathic hospitals, of which Boston, Johns Hopkins and Bellevue are excellent examples. Mental hygiene societies, notably in Connecticut, Illinois, Maryland and Massachusetts, and the National Committee for Mental Hygiene are doing a great public service in disseminating the knowledge gleaned from the hospital, clinic, laboratory and other research agencies. Of the latter, two in particular should be mentioned, — the Eugenics Record Office and the Vineland Laboratory. Both have performed most valuable services in the study of heredity, particularly in strains exhibiting insanity and feeble-mindedness.

It is particularly noticeable how in recent years the focus of interest of psychology and sociology has been toward the deviate and subnormal, and we hear much of practical economic and medical psychology, the latter sounding very much like psychiatry. The Binet-Simon measuring scale for intelligence, the production of two French psychologists, since its advent in this country has lent new impetus to the study of the feeble-minded and delinquent and at once furnished a new field which has attracted many workers. One of the results of this field of endeavor has been considerable overlapping of the psychologist and the psychiatrist, or as some would have it an overstepping on the part of the psychologist into the domain of medicine. If such has been the case the psychologist is not to blame as there has been no one else to do the work. However, the situation has created a demand for the psychiatrist with training in laboratory and applied psychology, such a physician being far better equipped to meet the needs of the situation than the psychologist with no medical training. The study of the feeble-minded and the delinquent seems to offer common ground for both the psychiatrist and the psychologist, but the latter's particular domain lies in experimental and laboratory psychology, but clinical work with the mentally abnormal and subnormal whether they be found in the school, dispensary or hospital should be the province of the psychiatrist. The spectacle of the non-medical psychiatrist making a medical diagnosis and suggesting treatment should never again be witnessed. The situation calls loudly for a new brand of psychiatrist, with sufficient training in applied laboratory psychology to apply intelligence tests intelligently and to analyze and interpret the findings in the light of which remedial measures and suitable occupation may be applied.

Occupational diagnosis as it is carried on to-day in a few factories and other industrial corporations seems to be more properly the sphere of the psychologist, although the need of medical training is often manifested even here; but occupational diagnosis among the subnormal is the function of the psychologically trained psychiatrist.

The school systems are gradually appreciating the need of particular care for the backward and deviate child, and we are on the eve of a rather widespread imitation of the Child Study Bureau of the Chicago Board of Education. Progress seems slow, however, when we realize that this particular bureau has been in existence twenty years. The value of such work, in placing the child in the proper special class or school, cannot be overestimated, if, indeed, the bureau was not the active agent in obtaining this special means of training. Then, too, such a bureau can quickly detect the feeble-minded. It is now generally appreciated that it is best for the child and most economical for the State that this condition, if present, should be discovered early in the school course. Such a child should be registered or recorded as feeble-minded, and never lost sight of. With the proper supervision applied, the State would be saved great sums now required for police, penal and custodial institutions, and the reproduction of the feeble-minded would be greatly diminished.

The discovery of the moron and the realization of the economic loss that is entailed through the anti-social conduct of this class is a very recent matter. The problem of the "correctional" institutions, "rescue" homes and "industrial" schools is in the majority of cases the problem of the moron, although not very frequently recognized as such. Indeed this class of trouble makers even to-day goes generally unrecognized. From judges on the bench down to the ordinary layman there is a startling need for education and appreciation of what these subnormals do and do not do.

The recent work of Stearns and Rossy in the Massachusetts State Prison shows what a large percentage of the convicts (22 per cent. in the first 300 prisoners examined) are definitely morons, and in addition there are 11 per cent., "borderline" cases. These figures point the way. There is no question but that a new criminology will be written when the moron is better understood. At present the law takes no cognizance of and makes no provision for him. Goddard's book, "The Criminal Imbecile," will arouse great interest, as it shows how important is the psychiatric examination of the anti-social. Already a few courts have made such provision, notably the Chicago municipal courts, where Judge Olson several years ago established a psychopathic laboratory in which suspected cases may be examined prior to trial. There is not the slightest doubt that Judge Olson's far-sighted innovation will be copied in all large courts throughout the land. In the domestic relations court particularly are the services of a psychiatrist required. Probably in no other court does disease of the central nervous system occur with greater frequency. Alcoholic psychosis, paranoias and feeble-mindedness are the common types witnessed, and the spectacle of a husband suffering from one or the other of these being sent to jail or the house of correction on non-support charges is frequently seen.

The day will come, and it may not be far off, when the law will make it impossible for the feeble-minded and unfit to legally mate, and in determining who shall and who shall not marry the services of the psychiatrist will be indispensable. Not only will a new criminology be written but a new penology. Each year shows a greater use of the indeterminate sentence, and an intelligent application of this measure means a thorough study of each case, and this requires adequate history, taking a social investigation and medical survey, the most important part of the latter being the psychiatric examination.

The problem of the delinquent boy and girl, generally speaking, is very imperfectly understood. In the attempt at solution many juvenile courts have been established in this country, but only those which have provided for psychiatric and medical examination can approach adequate results and these are very few and far between. Good examples of what should be done in detention examination and study are the Juvenile Psychopathic Institute of the Chicago juvenile court and the detention house of the Philadelphia court. The lack of proper handling in the juvenile court is responsible not only for the "repeater" there but elsewhere. Wherever a repeater is found, the delinquent boy or girl should have the benefit of a medical and psychiatric survey, and largely by the results thereof should the question as to permanent detention be determined. This assumes that the necessary laws for such a course are on the books. As a matter of fact, however, very few States make any provision for the permanent detention of the defective, the new Illinois law being a notable exception. Massachusetts has a law, but it has not been enforced. As conditions are now almost universal, the delinquent if not in custody (no effort being made to determine his mentality) is turned out among the people at twenty-one, just the age when most anti-social difficulties begin; and even if it were known that he is feeble-minded, in many States nothing else can be done at the upper age limit, for admission to institutions for feeble-minded is usually much under this. For instance it is sixteen in Maryland, — can there be anything more absurd? Just at the time when the feeble-minded girl becomes most dangerous to society through her liability to propagate feeble-mindedness, she either cannot be segregated or if she happens to be in a custodial institution she cannot be detained.

A prominent social worker the other day said, "I believe nearly all our cases are more or less 'borderline' and subject for psychiatric study." The work of the Mental Hygiene Society in Baltimore during the last three years shows how true this is. The society co-operates with all the charity organizations, and employs a psychiatrist who is at their call. The advantages gained thereby in suggesting a solution and treating the case have met with widespread appreciation, and the mental survey has become an indispensable part of charity work. The financial saving to the community pocket book is a very large item, but is secondary to the importance of helping formulate community plans for prevention of inefficiency, mental disease and feeble-mindedness. The study of the vagrant, the petty offender, the sexual delinquent and many other types and combinations, made possible only by the co-operation of many agencies, will no doubt be duplicated elsewhere, and whether carried on in similar or modified methods offers a large and new field for the psychiatrist.

There is probably no branch of medicine which has made greater strides into prominence than psychiatry. From the obscurity of institutional isolation it has emerged, within a few years, to become of widespread value and application in the community. The future seems to promise an even greater field of usefulness.

M. CHARCOT, PSYCHIATRIST, CLINICIAN AND SCIENTIST.

By Floyd F. Hatch, M.D., Boston.

On such an occasion as this, where men of the present gather to pay tribute to science by presenting the wealth of their researches, I think it fitting and admirable to direct one's attention to men of genius of the past, who by their energy, perseverance and keen observation under more adverse circumstances placed the foundation for an unparalleled advancement in psychiatry.

As a type, because of his general broad qualities and eminent success in medicine, as well as his striking additions to our knowledge of psychiatry and its treatment, M. Charcot of the French school stands alone in this century.

Born in Paris, Nov. 29, 1825, son of a carriage maker of modest means, he often related that on account of his father's inability to give to each of his sons a professional education, one day he said to them, "I am not able to have all of you complete your studies; he who will have succeeded best at the end of the year will continue his profession, another will be a soldier and the third a coachman like myself."

This was done and Jean M., which was M. Charcot's given name, won, and in consequence was sent to the Lyceum Saint Louis for his secondary studies. These finished, he was registered at the Faculty of Medicine. He was received as hospital interne in 1848, passed his thesis of doctor in 1853, and filled the duties of chief of staff for the following two years. For four more years he diligently applied himself to hospital work leading up to his second competition. In spite of his work and extensive knowledge he almost failed, and owed his success only to the last test, — the reasoning on his thesis.

He was fond of recalling the fact that during these strenuous years of study he gave private lessons in order to lessen the sacrifices which his family had self-imposed to educate him.

Nominated a physician of hospitals in 1862, he chose, never to leave it again, the service where he had been an interne, in that city of 5,000 souls called Salpêtrière, — that pandemonium of human infirmities. Before him the place was not coveted at all. But Charcot understood what an inexhaustible mine he had at his disposal there and he resolved to make it pay without delay. In his service he gathered together all of the "rheumatizing" patients populating the dormitories of the great hospital, and as a prelude of a career he was to make illustrious, he gave a thesis on gout, separating it from chronic rheumatism. Here he had collected together a very large number of people in this poorhouse, and among them many with chronic, incurable diseases. He had opportunities to watch the disease acute and chronic in old age, and, most important of all, he had unlimited pathological material to supplement his clinical observations. It is to the latter fact that he owed the beginning of his reputation. With his friend, M. Vulpian, he set to work to collect histories of all inmates and of all who entered the hospital. This collection forms the "Medical Archives of Salpêtrière." Of course these gave great advantage in following subsequently the pathological history and findings at autopsy. He made all autopsies personally and with minutest care, dictating personally his results and conclusions.

Laboratories were installed at Salpêtrière, and many fields of fruitful investigation, collaborating his clinical works, were directed by him. Except during short vacations he kept this up. The duty which he had imposed upon himself occupied the entire morning and often more. The abundance of excellent material so worked up constituted a vast wealth, which increased from year to year. From it came papers which he presented before various medical gatherings and which were printed, as he was an enthusiastic contributor to medical periodicals. His articles are said to be models of their kind.

His lectures, after his inauguration in 1866 as professor, began at Salpêtrière, not in the elaborate amphitheater as it now is, but in a simple ward cleared for the occasion. His course was followed eagerly, especially by former internes.

In 1867 he gave a free course of lectures devoted chiefly to hemorrhage and softening of the brain.

The following year, resuming his course at Salpêtrière, he described for the first time, among other diseases, paralysis agitans and disseminated sclerosis, until then confounded. Unfortunately only small parts of these early lectures have been preserved.

In 1869 he discovered the significance of arthropathies of ataxias, to which the English gave the name of Charcot's joint disease; also in this year he founded the Archives de Physiologie. To him we owe the discovery of amyotrophic lateral sclerosis, which has been called Charcot's disease.

In 1870 he opened his course with many foreign doctors present, and gave his remarkable lectures on "The Trophic Troubles Consecutive to Diseases of the Brain and Cord." The unhappy war of 1870 came and suspended them.

During the two sieges M. Charcot simply did his duty; besides regular work he took charge of a smallpox military hospital. Later a hospital for hysterics and epileptics had to be abandoned and part of its patients were sent to him. Fortune favored him, and science profited by it. His researches dating from this beginning are classical, scientifically, and all were carried out on cases of hysteria major. All know and appreciate how he utilized this new field of investigation placed at his disposal. After the war M. Charcot resumed his teaching, and published the first volume of his "Lectures on Diseases of the Nervous System."

In 1872 he was appointed professor of pathological anatomy at the Faculty of Medicine of Paris, occupying the chair until 1881. It was during this time that he gave his lectures on "Disease of the Lungs, Liver and Kidneys," "Pathological Conditions of Albuminuria," and "Localizations in Diseases of the Brain and Spinal Cord."

He made his lectures and demonstrations attractive by using unusual descriptive plates depicting the lesions on which he lectured. Once a week the public clinic was held in the large amphitheater accommodating 600 students and arranged with a stage and footlights. The place was always filled. After the audience had gathered, the dark shutters were closed over the windows, the footlights were turned up and the clinic began. Charcot was seated with his assistants on one side of the stage at a little table, the patients were brought before the footlights, facing the audience, either to display variations of one disease or to draw contrasts with other diseases. In a distinct but not loud voice Charcot would describe the case, call attention to special symptoms, show peculiarity of spasm or deformity or tremor or gait, compare them with other forms for the purpose of differentiation, and sum up the diagnosis. Then dismissing the patient he would begin to describe the lesion and at once a lantern on the opposite side of the room would flash out on the screen the picture of the lesion being described, as a drawing, sketch or actual slide of spinal cord or part of a brain magnified by a microscope.

Thus, symptomatology, diagnosis and pathology were presented in orderly succession in a clear, forceful manner and with an effect that was most impressive and instructive. It has been said that the whole clinic was arranged for theatrical effect. However, granting in part that it was, it also was the only possible way to show in such detail and demonstrate in such a clear light to large audiences all features, clinical and pathological, of such subjects. He produced results; students appreciated him.

His position as president of the Anatomical Society (1872–82) brought all unusual specimens to his observation, and he used this material in most interesting, elaborate lectures. It was during this time that he published his lectures on "The Anomalies of Locomotor Ataxia," "The Slow Compression of the Spinal Cord," "The Spinal Amyotrophies," and "Partial Epilepsies of Syphilitic Origin," etc.

In 1873 he founded "Le Progrès Médicale," later "Revue Muselle de Médicine et Chirurgie" and "Archives de Neurologie." His book on "Maladies of Seniles" is a brilliant reflection of his knowledge of that date.

In the stress of criticism by contemporaries, as when accused of cultivating hysteria but not curing it, he was most accustomed to answer, "To learn to cure, one must learn to know, the diagnosis is the best trump of the treatment."

In 1882 the desire of his life was realized. A clinical chair for nervous diseases was created for him at Salpêtrière. Before this time he had been unofficially recognized, for by state aid buildings had been put up which had made his service a true neuropathological institute. In his opening address he affirmed "the decisive influence that microscopic investigations have had on the progress of neuropathology when directed according to the anatomo-clinical method."

It has been written, through ignorance or dishonesty or both, that M. Charcot took no trouble to cure his patients. An absurd assertion, because, had it been so, he would not have seen the crowd of people that flocked to him for treatment.

Besides voluminous writings of note on the nervous system and hypnotism, therapeutics as well as other branches of medical sciences owe numerous contributions to his pen.

He was elected member of the Institute in 1882 and was appointed commander of the Legion of Honor in 1892.

In order to show how much his works were appreciated abroad, it should be mentioned that a great number of them have been translated into the English, German, Spanish, Italian, Magyar and Russian languages. No one among his contemporaries has been so highly honored, a fact which moreover reflects immortal credit on French science. His teachings to his own students and to all others who followed his course have never been surpassed by any one. It was not ordinary subjects that he chose, but sometimes those that were entirely original, such as multiple sclerosis, the arthropathies, pathogenesis of cerebral hemorrhage, etc. He always furnished the bibliographical references appertaining to the history of the question when it was not an analysis made by himself of these works. Knowing German and especially English, he always kept himself well posted in science, and derived pleasure in giving to each one the justice that was due him. All his works are witnesses of it, and all have long bibliographies appended.

As great a physician as he was, he was an artist. He knew the museums of Europe as few knew them, even among professional artists, often astonishing the latter by the extent of his special knowledge. He would have made an excellent expert in painting. His musical education was not less than that in art. Not only an admirer of art, he himself practiced, not without success. The sketches which he exhibited in his courses and which illustrate his books have been much admired. He copied many famous paintings, and with his own hand did much of the decorating in his elaborate mansions.

It is a fact that there never lived a harder worker. His constant occupation, outside the examination of his patients, wherein he excelled, was the reading of French and foreign publications. He annotated, made extracts from them, which he collected to his very last days, pasting them with his own hands into special books, just like a beginning student.

He was a man of great dignity, of calm repose, of even temper, of slow thought and utterance, but of much reserve power. In appearance like Napoleon, and in manner reserved and observant, he was not the type of man to be popular.

His domestic life was a delightful one. He was married early in life to a lady of considerable wealth, who was enthusiastic in his work, and by whose aid many scientific undertakings, otherwise impossible, were carried out. He had two children, one a son who became a physician of prominence.

Madame Charcot devoted herself to her husband and his work;

without her aid many of his most brilliant lectures and papers would have gone unpublished. His house was open every Monday evening to his friends and pupils, and a considerable company was glad always to gather about him, to enjoy his hospitality and to profit by the interesting discussions which went on.

His unexpected death came while on a holiday vacation to the shores of the Lake of Lettous. He succumbed to an attack of angina pectoris after a few brief minutes of suffering.

Like every man of prominence, Charcot had his enemies, critics in science and rivals in medicine. Yet after all the criticism is exhausted, we must admit that Charcot is one of the greatest physicians in French history.

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SOME UNUSUAL CONDITIONS OBSERVED IN 245 POST-MORTEM EXAMINATIONS AT DANVERS STATE HOSPITAL.

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In a service of more than two and one-half years at this hospital, embracing 245 post-mortem examinations, a great variety of interesting and unusual conditions has been encountered. A number of the more interesting of these, which are not of sufficient importance to warrant separate notes, but are nevertheless striking enough to merit a place in the literature, have been brought together in this paper. For the most part, they are presented merely as facts of observation. Some of the conditions are perhaps not so unusual in other laboratories as in this. Nevertheless, the number and variety of the conditions here reported may serve as an indication of the remarkable medical and pathological material an institution such as this holds.

A great many other cases which might be included in such a series as this have been or will be reported either singly or in groups.

Head and Cord.

Hemorrhage. — In one case of paresis (1789), age thirty-eight, there were hemorrhages into the dura of the head, beneath the dura throughout the extent of the cord, and beneath the arachnoid over the lower third of the cord. Death was sudden.

A non-paretic case (1860) showed clotted and fluid blood beneath the dura over the left hemisphere, most marked in the frontal region, with narrowing and lengthening of the hemisphere. There was also cortical hemorrhage in the left occipital region. Probable cause, head trauma.

Two cases of paresis (1894 and 1933) showed subarachnoid hemorrhages. The first died suddenly, when seemingly in good condition, and the hemorrhages involved the arachnoid around both Sylvian fissures. The second had been very violent. The hemorrhage was limited to the arachnoid of the cerebellar notch.

Most unusual were the widespread subarachnoid hemorrhages in a non-syphilitic imbecile (1923), age thirty-seven, involving the base of the brain, the Sylvian fissures and the cord. Death was sudden, and the engorgement of the neck veins, with marked cyanosis of the face, had led us to expect some thoracic condition.

Hemorrhages into the substance of the brain, in the sense of an apoplectic stroke or shock, were relatively common, especially in the group of cases with well-marked arteriosclerosis. However, hemorrhage into the meninges or between the meninges is an extremely uncommon finding. We have here five cases in which it was found. Three of these cases were paretic, in which there were, of course, lesions in the vessels which might cause this. In the fourth case, in which there had been trauma, the cause also seems clear. In the fifth case, where the hemorrhages occurred in a non-syphilitic imbecile who was in excellent physical condition, the cause remains absolutely obscure. It may be noted that hemorrhage in paresis is a rare thing despite the lesion of the vessels.

Tumors. — In a case of senile dementia (1780) was found a fibroma of the eighth nerve "about the size of a hazelnut." Hearing was "a little dulled."

A case of organic brain disease (1849) showed at autopsy a dural endothelioma, occupying the right cerebello-pontine angle, 5 by 5 by 2 centimeters. This was closely adherent to the pons and to the dura on the posterior surface of the petrous portion of the temporal bone. The pons and medulla were remarkably pressed out of shape, but stained sections show no degenerations in any fiber tracts. The tumor is an endothelioma.

This case had shown before death an internal strabismus and had much exaggerated knee jerks. Owing to the patient's marked confusion only an objective examination could be made, from which it was concluded that she had an organic brain disease with the possibility of a brain tumor.

In the whole series of 245 cases, 4 cases (including both of these) of brain tumor were found. In other words, brain tumors are uncommon among the insane.

As I have pointed out elsewhere, there have been a total of 28 brain tumors in the entire series of 1,985 of Danvers' autopsies. This is, perhaps, a somewhat smaller percentage than is commonly found, but the fact remains that in not more than 5 per cent. of the insane are there brain tumors to account for their disorder.

A case of paresis (1896) of five years' duration showed a large mass covering the entire right frontal lobe, approximately 10 by 8 by 2.5 centimeters with central cavity. This was closely adherent to the dura, and represents the classical extreme stage of internal hemorrhagic pachymeningitis. This condition in any of its grades has been uncommon in this series, although the minor stages have been encountered. This is, however, the only marked case.

Meningitis. — Two cases of acute purulent leptomeningitis were encountered.

The first (1857) occurred in a man who had shot himself through the head five weeks previously, cutting the right optic nerve and just missing the left. The sella turcica was uninjured. The right eye had been enucleated. The orbital portions of the frontal lobe were necrotic and the dura was adherent. There was a purulent meningitis involving chiefly the base of the brain.

The second case (1972) represents an error due to the infantile paralysis scare of the past summer. The man's illness was thought to be poliomyelitis at first, but was later diagnosed meningitis. He was sent here as insane. The total duration was about eight weeks. The autopsy showed a pronounced meningitis at the base. A short chain streptococcus was demonstrated, together with a pronounced polynucleocytosis. There was a double purulent otitis media and frontal and ethmoid sinus infection.

Aneurysm. — An arteriosclerotic case (1980) showed, in addition to various softenings, a small aneurysm, 1.5 centimeters in diameter, of the middle cerebral artery in the depths of the Sylvian fissure.

Arteriosclerosis of the cerebral vessels is a rather common finding. It is found on the whole in two groups of cases: in those whose psychosis comes on in advanced life where the arteriosclerosis may or may not be the etiological factor in the psychosis; and in a second group representing those whose psychosis comes on in earlier life but who live to an advanced age. Some idea of the probable amount of sclerosis may be gathered by the statement that about 60 per cent. of our autopsies are done on people over fifty at the time of death. This is the only case in which we found any aneurysm in the cerebral vessels.

BONES.

One case (1893), an old imbecile, showed osteitis deformans. The skull had several unusually marked prominences on it. In removing the calvarium, the outer table was several times broken through merely by pressure of the fingers. Its consistence was that of rotten wood, and its thickness varied from 1.5 to 2.5 centimeters. It was extremely cancellous.

The occurrence of persistent metopic suture in 4 cases may also be noted.

CARDO-VASCULAR.

One case (1818), with a heart weighing 745 grams, showed, at the apex of the left ventricle, an area of very marked thinning of the muscle, from 2.5 centimeters elsewhere to .5 centimeter. Here there was a large grayish softened mass, which was easily removed. This was a very large thrombus (there was marked arteriosclerosis, fibrous myocarditis and chronic interstitial nephritis).

In 2 cases (1822 and 1842) there was thrombosis of the pulmonary artery; in the former, of several small branches; in the latter, of one large branch.

One case (1823) showed at fifty-six a thrombosis of the descending branch of the left coronary artery to account for the sudden death.

Autopsy No. 1981 is especially striking. This woman, age fifty-two, had complained of pain in her legs for three weeks before death. About one week prior to death, the ends of the toes began to dry up, so they became hard, with a translucent yellowish red appearance. For some days there was a marked purple color of the left leg, with swelling and induration, and a less marked condition in the right leg. At autopsy there was found a white thrombus filling the abdominal aorta from about 5 millimeters below the origin of the renal arteries, and extending into both iliacs and femorals. In the femoral arteries it became red. It extended beyond the point to which the arteries were traced down the legs, *i.e.*, about half-way to the knee. There was only moderate arteriosclerosis, but very marked anæmia.

Autopsy No. 1982 is no less striking. This woman had passed a good night. In the morning she suddenly became ill, and died in a very short time, gasping for breath, the pulse small and weak. The autopsy showed a recent large hemorrhage into both adrenal capsules. Each adrenal weighed from 55 to 60 grams. There was moderate sclerosis of the aorta.

LUNGS.

A number of cases of pulmonary œdema of obscure etiology were encountered. Probably the most striking lung condition found was in the following case (1788): —

This woman, a case of dementia præcox, had partaken freely of oranges and grapes the day previous. Later she became very restless, and vomited a few minutes before death. At the autopsy, there were large, undigested masses of orange fiber and half and whole grapes in the stomach. Similar material was found in the œsophagus, mouth, larynx, and plugging the left bronchus and partly occluding the right. Small pieces were found in smaller bronchi.

Two other cases in the series showed an acute lung condition due to aspiration of regurgitated stomach contents. In view of the large number of cases which require tube feeding, and the not inconsiderable number of cases who regurgitate their food to a considerable extent, the number of cases of asphyxiation or pneumonia due to aspiration is remarkably small.

INTESTINES.

Two cases (1837 and 1797) showed ulcers and multiple perforations of the cæcum, with resulting peritonitis. One of these cases was operated on, because of symptoms of appendicitis, about three days before death. In this case, the lesions were definitely tubercular.

One case (1748) showed a strangulated femoral hernia. One side of the ileum had herniated and become pinched off. There was a typical picture of acute intestinal obstruction.

A very remarkable case was 1766. A very obese woman showed an enormous lobulated umbilical hernia, measuring 25 centimeters across and protruding 20 centimeters from the body wall. In this were the lower end of the stomach; all of the small intestines; the large intestine, excepting only the cæcum and the lower end of the descending colon; the apex of the very large bladder; an adhesive band from the liver. This case also showed a large fibroid with a calcified shell, and calcified strands running from the center. The enormous hernia was strangulated.

Duodenal ulcer occurred five times (1771, 1916, 1926, 1927 and 1929). Three of these cases showed two ulcers. In 4 there had been perforation, and in 2 both ulcers had perforated. One case (1771) is regarded, from the history and the histological examination, as a case of typhoid fever. The unusual location of the ulcers is very interesting.

Autopsy No. 1873, on a male paretic, showed a very soft, necrotic œsophagus and neighboring portion of the stomach. There had been a perforation in this region, and as a result the parietal pleura and visceral pleura over the entire posterior surface of the left lung had been digested away. The ribs were bared. Air could be forced out through the opened alveoli.

In case 1879 the cæcum lay just to the left of the midline, with the appendix running off to the left. The ascending colon ran in the midline. The transverse colon was very short, running from the midline upward and to the left to the splenic flexure. The small intestines were all to the right of the ascending colon. This case represents an incomplete fetal rotation of the intestines.

In 1921 there was volvulus. The sigmoid was twice twisted on itself, forming a very complete intestinal obstruction.

In 2 cases small "pebbles," about the size of beans, were found free in the peritoneal cavity. These were calcified and may represent necrotic and calcified appendices epiploica.

Gall Bladder.

Gallstones and chronic cholecystitis were very common in the series. One case (1978) deserves especial mention. Here there was a gall bladder measuring 7 by 4.5 by 5 centimeters. The walls were thick and white, the anterior being 2 centimeters in thickness. There was much calcification in the wall. The cavity measured 4.5 by 2.5 by 3 centimeters, and was packed with stones.

Liver.

Cases of frank cirrhosis were very rare, despite the pronounced alcoholism of many cases. Two cases (1807 and 1910) showed scars on the upper surface of the liver. In 1 case there was syphilis, in the other it was suspected, but the Wassermann was doubtful. (This case, 1910, also presented a condition which is unique in the experience of this hospital. Thus we have many cases of syphilis of the nervous system, and a number of cases of syphilis without involvement of the nervous system, but this is the only case in which we have found necrosis of the nasal septum and soft palate. The nose had the typical "saddle shape." The psychosis in this case was *not* due to neurosyphilis.)

Tuberculosis.

This has occurred to a marked degree in about 5 per cent. of the series, which is rather less than in former times. Two cases were very striking.

In the first (1833) a woman of eighty-six had what was regarded as a broncho-pneumonia. There was atrophy of the liver. The mesenteric and retroperitoneal lymph nodes were much enlarged, firm and white, leading to the supposition that there was a tumor which, however, was not found. Microscopically, there was a very remarkable miliary tuberculosis of lungs, liver and lymph nodes. In the liver the areas are very minute. In view of the age of the patient, this was absolutely unexpected.

In the second (1871) the man (fifty-four years of age) had been feeling badly for about ten days, but made no special complaint. There was pronounced tuberculosis of the lungs; of the peritoneum; miliary tubercles in spleen and liver; and an extremely marked tubercular process in kidneys, ureters and bladder. One kidney was merely a shell around a large mass of caseous material. Both ureters were greatly enlarged, with much thickened, very hard walls.

Considering the length of time the tubercular process must have been active, the absence of symptoms in this case, the man being up and working each day, is truly remarkable.

URETERS.

Pyelitis has been rather uncommon, as contrasted with its frequence in earlier years.

One case (1915) showed complete bilateral doubling of the ureter. That is, there was a double pelvis in each kidney; a double ureter on each side, and four independent openings into the bladder.

Such cases are rare, as judged by their infrequent appearance in the literature. They have been very infrequent here. There is one other case (1279) among 1,985 autopsies in which there were two complete ureters on each side, with five openings into the bladder. One of the right ureters was drained by two openings.

One other case, showing double ureter on one side, with union before reaching the bladder, has occurred in this series.

TUMORS.

It has been stated above that tumors of the brain are relatively uncommon in the insane. This is no less true of the body organs in general; thus, carcinomata occurred in only very few cases and there has been no case of sarcoma. In one case (1824) there was carcinoma of the pyloric end of the stomach. One case of carcinoma of the prostate (1810) occurred. In 1 case (1883) there was a carcinoma of the epithelium covering the hard palate with metastases. There was one dermoid cyst; and 2 cases showed calcification of fibroids.

In 1817 there was a small primary carcinoma of the thyroid, with metastases to the liver and lungs. Case 1939 also showed carcinomatous areas in all the body organs.

The most interesting case was 1831, a woman of thirty-four. There was a walnut-sized carcinoma of the body of the pancreas, and a slightly larger hemangioma of the liver, neither of which was instrumental in causing death. The relative youth of the patient, the unusual situation of the carcinoma and the combination of carcinoma of the pancreas and hemangioma of the liver in this case are all very interesting. If, indeed, tumors be due to fetal rests, one might think that there would also be in this case fetal rests or arrests in other loci, particularly the nervous system (to account for the psychosis). However, there was in this case no indication of tumor of the brain, and the brain, on the whole, was a rather normal looking one.

GENERAL.

One case (1891) is of considerable interest. This man, age fifty-six, entered the hospital in a delirium which was ascribed to a cardiorenal condition because of the ascites and general œdema. The autopsy revealed a generalized infection with the gas bacillus (nervous system not affected). The solid organs, such as the liver and heart, would float in water. The liver had the appearance of a rubber bath sponge. There was a large recently healed scar of varicose ulcer.

It is obvious that no attempt has been made to discuss the pathological findings in mental diseases. In further reports upon this series of autopsies by groups this will be done. We have not presented here the cases which were unusually striking from a psychiatric point of view. The attempt has simply been made to point out some of the more unusual physical conditions that have been found.

A CASE OF PERNICIOUS ANÆMIA IN A SYPHILITIC TREATED WITH SALVARSAN.

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Pernicious anæmia as a cause of mental disturbance is uncommon, at least in this hospital, forming only a small fraction of a per cent. of the admissions. The psychosis is usually in the form of a depression.

This case is, therefore, unusual in the form of the psychosis. In addition, there was an interesting diagnostic problem, and finally, the man had been treated with salvarsan within a few months prior to the development of the anæmia.

It is not my intention to present a study of the cerebral pathology as such; that is reserved for use in another connection.

Male, age thirty-seven, admitted to Danvers Oct. 27, 1914. Born in Germany, 1877. Family history not remarkable. "Spinal trouble" as a baby. Operated for inguinal hernia, 1896. Otherwise well. Meager education. Has worked as cooper, tinsmith and baker, which occupation he has pursued for some years. In his youth well liked, jovial, easy going. Intoxicated three or four times a year for many years, increasing of late.

At twenty a chancre, with treatment "for some time." For five years past treated for chronic nephritis. In July, 1913, went to the Massachusetts General Hospital complaining of feeling weak; headaches and abdominal distress. Wassermann reaction blood serum strongly positive. X-ray of abdomen gave a picture diagnosed as adhesions in right upper quadrant, involving stomach and hepatic flexure. In August and September he was given four doses of .3 gram salvarsan. In October, condition good. In November, complained of cough. X-ray diagnosis: phthisis with calcification. Physical: lungs negative. In June, 1914, Wassermann reaction blood serum positive. June and July, two doses salvarsan.

For ten years migraine attacks, increased in severity and frequency of late. Married in 1906. No children. No miscarriages. For about four years very nervous, aggressive, irritable, violent temper. For three years unable to work steadily, and for seventeen months, no work. Wife twice left him in this period because of his attitude toward her. For the past year practically always in a fighting mood. Twice arrested for fighting and drunkenness. Two weeks before commitment, secreted a knife under his bed clothing. About this time delusions became prominent. Thought he was dying. Wanted to become a Catholic so he could claim his wife in the next world. Prayed much. One night said to his wife, who was lying quietly in bed, "Why are you dancing, and why is the house shaking?" Complained of white pigeons hanging over him.

The next night he became violent, leaped through the glass in a door and ran amuck on the streets in his night clothes, with a milk bottle as a weapon. Taken by the police to a general hospital, he was committed here three days later.

Here he was constantly restless, talkative and noisy; disoriented in all spheres; hallucinated and deluded. He had visual and auditory hallucinations. Thought he had been murdered, his body sawed in two in the median line. Then thought he was a Jewish rabbi in a Jewish church. Thought they were making a rocking-chair out of his body. Much of his conversation was incoherent. Afraid of being poisoned. Thought his eyes had come out of his body. Marked impairment of memory. Sense of choking.

Physical Examination. — An emaciated man with yellow skin (not jaundice). Heart enlarged; all sounds feeble. A presystolic murmur at the apex transmitted upward. Liver dullness extended three fingers below costal border. Liver not felt. Spleen not enlarged. Penile scar. Pupils equal; react sluggishly to light and accommodation. Slight œdema of feet. Knee jerks increased. Shuffling gait. Positive Romberg. Suggestion of Babinski. Sterognostic sense unimpaired. Tactile appreciation normal.

Wassermann on blood serum negative; spinal fluid negative; albumen normal; globulin negative; cells 3; gold 00000 00000. Blood examination; hemoglobin 40 per cent.; red cells 680,000; white cells 7,600. Eosinophiles .6 per cent.; polynuclear 66.6 per cent.; mononuclear 32.6 per cent. Normoblasts and macrocytes were observed. There was poikilocytosis and polychromatophilia. Hemoglobin 35 per cent.; red cells 500,000; white cells 6,500.

As he failed he became quieter. Diagnosis, Nov. 12, 1914: at first thought to be paresis, and some thought so even with the normal fluid; others, psychosis associated with pernicious anæmia.

Autopsy No. 1773. — Two hours post mortem. Summary of the autopsy findings: skin yellow; inguinal adenitis; pupils equal, dilated; fat, deep yellow; adhesive pleuritis, right and left; blood fluid, very light red color; hypertrophy and dilatation of heart; mitral stenosis; aortic valve fibrosis; "tiger lily" heart; active and healed (calcified) tuberculosis, both lungs; fatty kidneys, fibrosis; fatty liver.

Head: Scalp not remarkable. Calvarium thickened in occipital region. Wide line of diploë. Dura thickened, silvery white, not adherent. The pia is very slightly thickened. Basal vessels not sclerotic. Brain weight, 1,275 grams. Pons and cerebellum, 160 grams. Cerebellum firm. Floor of fourth ventricle smooth. Brain somewhat soft with "sticky" feel. Frontal atrophy. Brain very pale. Pia adherent.

With the exception of the slight changes in the pia, there is nothing in the gross brain findings to indicate paresis.

Microscopic examination: Heart, kidneys, liver and adrenals show very marked fatty changes. There is a sub-acute tubular nephritis. The lungs show active and healed tuberculosis. A peribronchial lymph node also shows a cellular tubercle. Hypophysis, slight connective tissue increase in anterior lobe.

Nervous system: Ten areas of cortex, 2 of the cerebellum, 1 of the medulla and 3 of the cord show none of the classical findings of paresis. There is slight fibrous thickening of the leptomeninges. At one point between the cerebellar folia is a single small collection of round cells. Judging by the appearances in surrounding areas, these cells are migrated glia cells.

There are no degenerations by the Marchi and Weigert methods.

The most important diagnostic question involved here was whether or not the man was a paretic. Obviously, from the description, he was not.

However, there are other important points. Salvarsan has been used in the treatment of anæmia, apparently without untoward effects. In this case pernicious anæmia developed some time after treatment with salvarsan. Whether this relation is purely incidental is uncertain, although it probably is, in view of the large number of persons who have been treated with salvarsan.

THE MASTICHE AND POTASSIUM PERMANGANATE TESTS APPLIED TO THE CEREBROSPINAL FLUID OF THE INSANE.

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A.—In the *Berliner Klinische Wochenschrift* for July 26, 1915, G. Emanuel describes a new colloidal reaction for use in examining cerebrospinal fluid:—

> The technic is as follows: Dissolve 10 grams mastiche in 100 cubic centimeters of alcohol. Filter. Take 1 cubic centimeter of the above stock solution and add to 9 cubic centimeters of alcohol. Insufflate rapidly into 40 cubic centimeters of distilled water. This is the reagent. It is a pearly gray, opalescent solution with a slight bluish tinge. One cubic centimeter of 1.25 per cent. sodium chloride solution will flake out 1 cubic centimeter of mastiche reagent. Set up 5 tubes. In the first put 1.5 cubic centimeters of the 1.25 per cent. sodium chloride solution; in the others, 1 cubic centimeter. To the first tube add .5 cubic centimeter of spinal fluid. Mix. Transfer 1 cubic centimeter to the second test tube; mix; and so on for the first 4 tubes, throwing away 1 cubic centimeter from the fourth. The fifth is used as a control.
>
> Now add 1 cubic centimeter of the mastiche reagent to each tube. A positive reaction is evinced by a prompt precipitation in all 5 tubes. The reading is made at the end of twelve hours. This occurs in paresis or other syphilitic nervous disorders. In 32 cases Emanuel found the test negative in all but the 14 syphilitic. One case of dementia præcox, 1 of traumatic neurosis and 1 of hemorrhage gave faintly positive reactions, but not to be compared with the pronounced reaction of paresis.

On account of the simplicity of the test and the statement that it is as reliable as the gold reaction, it seemed worth while to try it in the laboratory. Fluids from 35 cases were examined, the test being controlled by the routine tests of this laboratory (Wassermann reaction, albumen and globulin content, cell count and gold reaction).

The dilutions were made, the reagent added and the tubes thoroughly shaken. They were then examined at the end of five minutes, after one to one and a half hours, and finally at the end of eighteen hours. As a general rule no change or at most a very slight change occurs between the hour and the eighteen hour observations.

In 3 cases, 10 tubes were set up, the tenth being used as a control, and the other 9 containing fluid dilutions of 1 : 2 to 1: 512. In all 3 cases, whether positive or negative, the last 5 tubes precipitated, *i.e.*, the amount of restraining (?) substance in these dilutions of the fluid was not sufficient to prevent precipitation.

Three general types of reaction may be recognized. In the first the completed test solution is "clear" (*i.e.*, only slightly opalescent); in the second the solution is "cloudy" or opaque; in the third flocculent precipitation occurs, the supernatant fluid being clear.

The results of the test are given in the appended Table I, in which the fluids are arranged according to the gold reactions.

[c = clear; cl = cloudy; p = precipitate; M = male; F = female; sl = slightly.]

TABLE I.

		1	2	3	4	Control. 5
	Gold Positive.					
M.	General paresis,	cl	cl	cl	cl	p
F.	General paresis,	p	p	p	p	p
M.	General paresis,	p	p	p	p	p
M.	General paresis,	p	p	p	p	p
M.	Tabo-paresis,	p	p	p	p	p
M.	General paresis,	p	p	p	p	p
M.	General paresis,	p	p	p	p	p
M.	General paresis,	cl	cl	cl	cl	p
M.	General paresis,	c	c	c	cl	p
M.	General paresis,	p	p	p	p	p
M.	General paresis,	p	p	p	p	p
M.	General paresis,	p	p	p	p	p
M.	General paresis,	cl	cl	cl	cl	cl
M.	General paresis,	p	p	p	p	p
M.	General paresis,	cl[1]	cl	cl	cl	p
M.	General paresis,	cl	cl	cl	p	p
M.	General paresis,	cl	cl	cl	cl	p
M.	General paresis,	p	p	p	p	p
M.	General paresis,	cl[2]	cl	cl	cl	p
M.	General paresis,	p	p	p	p	p
M.	Cerebrospinal syphilis,	c	c	c	cl	p
	Gold Negative.					
M.	Arteriosclerosis,	c	c	c	c	p
M.	Imbecile,	p	p	p	p	p
F.	Senile dementia,	c	c	c	c	p
F.	Imbecile with syphilis,	c	c	c	cl	p
F.	Manic-depressive,	c	c	c	sl cl	p
F.	Manic-depressive,	c	c	c	cl	p
M.	Arteriosclerosis,	cl	cl	cl	p	p
F.	Organic,	c	c	c	p	p
F.	Dementia præcox,	c	c	c	cl	p
M.	Dementia præcox,	sl cl	cl	cl	cl	p
M.	Dementia præcox,	c	c	c	c	p
M.	Alcoholic,	cl	p	p	p	p
M.	Alcoholic,	c	c	c	c	p
M.	Gold tumor type, Glioma,	c	c	cl	sl p	p

[1] Contaminated.

[2] Bloody.

Some contaminated and bloody fluids were purposely included in the series in order to determine what difference, if any, this would make. If there was any difference (which is not demonstrable) it was in the direction of rendering a positive reaction negative. Of 21 fluids in which the gold reaction was positive (all from cases of nervous syphilis) 9, or 43 per cent., did not give precipitation in any of the test dilutions (except 1 in a 1:16 dilution). Seven gave "cloudy" solutions and 2 "clear" solutions. In both of the latter the 1:16 dilution was "cloudy." Among 13 cases not due to syphilis in which the gold test was negative, 2 gave positive mastiche tests and 2 others showed precipitation in the 1:16 dilution; in 4 cases all test dilutions were "clear" and in 5 more only the fourth showed "cloudiness" or precipitation. Two cases were "cloudy" in all test dilutions. One interesting case is the following: —

> A male tabo-paretic had several times given a weakly positive gold reaction (tabetic type). Fluid removed from the lumbar region at autopsy gave the following gold reaction: 4-5-5-5-5-4-4-2-0-0. Fluid from the base of the brain gave: 5-5-5-5-5-5-4-2-1-0. The mastiche test gave at the end of an hour: cord, cl-p-p-p-p; base, p-p-p-p-p.
>
> At the end of eighteen hours all tubes in both tests were precipitated.

The significance of "clear" and "cloudy" solutions and of precipitation in the fourth tube is by no means certain. We cannot assume that cloudy solutions and precipitation in one tube are to be regarded as evidence of a positive test, since both changes occur in fluids which otherwise are negative. If we are to regard as positive only those cases in which precipitation occurs in all tubes it is evident that the percentage of positive tests in the group here reported is very low and that the test does not offer a very safe means of determining the presence of syphilis of the nervous system.

Considering the data in this light it seems obvious that the mastiche test is not a valuable addition to our diagnostic armamentarium. It obviously cannot do the work of the gold test and does not seem to add any information which cannot be obtained from other tests.

B. — P. Boveri described the following test in *Riv. di Patol. Nerv. e Ment.*, page 280, 1914: —

> To 1 cubic centimeter of spinal fluid add slowly down the side 1 cubic centimeter of 1 per cent. potassium permanganate. In a normal fluid the contact zone shows no color change. Having observed the ring the fluids

are mixed. If the fluid is pathological the mixture assumes a straw-yellow tint.

Reactions are classified as follows: strong reaction, change in less than three minutes; moderate reaction, change in three to four minutes; weak reaction, change in five to six minutes. Changes occurring after six minutes have no meaning.

The test is said to be best marked in myelitis; to be more sensitive than the Nonné and Noguchi, but not parallel with them, and not parallel with lymphocytosis.

I have not had opportunity to use the test in myelitis cases. My cases are of cerebral rather than cord diseases. This may, perhaps, explain the aberrant findings here recorded. At any rate it does not appear that the test is of value in the examination of spinal fluid from the insane.

The ring test showed a reddish zone in only 1 case; in the others, nothing. The first appearance of the shaken mixture was "transparent purple" in 3 cases; "opaque purple" in 17. The 3 cases eventually gave a transparent red-straw color (six minutes: translucent red at the end of two minutes). All 3 of these fluids gave a positive Noguchi test and were from cases of paresis. The tests of the other 17 cases remained opaque purple in color throughout the time of observation. Of these, 8 gave a negative Noguchi test, 2 contained blood and 7 gave positive Noguchi test and were from cases of paresis.

From these data it seemed unnecessary to proceed further with the test.

Conclusions.

From the data presented, dealing with the mastiche test on 36 fluids and the permanganate test on 20 fluids from insane persons, the conclusion is drawn that neither of these tests is of sufficient value to become a part of the routine examination of spinal fluids from the insane.

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CEREBROSPINAL FLUID TESTS, ESPECIALLY THE GOLD REACTION, IN PSYCHIATRIC DIAGNOSIS.

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Introduction.

The value of the examination of spinal fluid withdrawn by lumbar puncture from insane patients has been thoroughly proved in many hospitals. The refinements in the technique of old tests and the new tests added have, in the last five years, given to the examination of spinal fluid the first place in the diagnostic laboratory of the insane hospital.

The early tests of clinical application were relatively simple. For many years cyto-diagnosis, globulin tests and inspection were the main reliances. The first great step in advance was the application of Wassermann's method to the spinal fluid. At first .2 cubic centimeter of fluid was used. This did not give a very high percentage of positive results, and later the amount was increased to 1.0 cubic centimeter. Using this quantity, very many more positive results were obtained in paresis with the result that the test became of great importance. Plaut's[21] monograph was a very great stimulus. In the meantime, the protein tests and methods for cell counting have been elaborated. Finally, in 1912, came Lange's test, the Gold Sol reaction, which is of differential value.

The literature dealing with the technique and results of tests on the spinal fluid is of enormous volume. This paper makes no attempt to cover this; only those articles bearing directly on the questions immediately at hand are here considered.

The various methods used from time to time in this laboratory are considered in some detail. All tests here reported (save the Wassermann reaction) have been performed by myself or under my direct supervision, hence my responsibility for them is complete. The diagnoses in all cases were determined by the assembled staff after all data were at hand. It may be stated that no question of personal bias could enter into the interpretation of results, since no "provisional diagnosis" accompanies the specimens to the laboratory.

A portion of the tabulation of results was done for me by Mr. G. A. Clark, interne in the hospital, summer of 1915, to whom I hereby express my thanks.

METHODS.

1. *Wassermann Test.* — All tests are performed in the testing laboratory of the department of disease of the nervous system, Harvard Medical School, now the Wassermann Laboratory of the State Department of Health. For details concerning the method, the papers of Southard[28] and Lowrey[15] may be consulted. It is only necessary to state that the fluid is used in the amount of 1 cubic centimeter, and that a cholesterin fortified antigen and extract of syphilitic fetal liver were used. Various objections to the use of 1 cubic centimeter of spinal fluid in the test have been urged, notably that in this way many will be found positive which are not really so. Further, using 1 cubic centimeter the differentiation between paresis and cerebrospinal lues according to Plaut's findings is rendered impossible in a large majority of cases. As will be shown in the later discussions, positive tests in the spinal fluid with this method were found in very few cases in which syphilitic mental disorder was not directly indicated by other examinations. Hence, the method can be said to serve its purpose very reliably.

2. *Cell Counting.* — The earliest method in use was the centrifuge method of the French workers, introduced by Widal and Ravaut. The objections to this were obvious and serious. The first advance toward greater accuracy was the introduction of an ordinary blood-counting chamber. Then Fuchs and Rosenthal introduced the special chamber having their name, which is .2 millimeter deep and 4 millimeters square, giving a volume of 3.2 cubic millimeters.

In the first American report on the examination of cerebrospinal fluid from the insane by Cornell,[1] this method was used. In the following year, Cotton and Ayer,[2] working in this laboratory, made use of the Alzheimer method. They criticized the Fuchs-Rosenthal method, on the basis of a large error where there are only a small number of cells, and on the fact that a good differential cannot be made. They regard the Alzheimer method as the best of all, as it allows a good differential and fair quantitative count.

Donald[3] has described a drop-method for counting the cells, which at the same time gives permanent stained preparations.

This method promises to be of real service and the technique is relatively simple.

In all of the cases here reported, the Fuchs-Rosenthal method was used. All objections to the contrary notwithstanding, the method is simple, does not consume an inordinate amount of time, and the results are accurate within reasonable limits — probably more accurate than any other method yet devised.

The stain originally recommended has been replaced in this laboratory by polychrome methylene blue. The spinal fluid gets to the laboratory within an hour of its withdrawal. It is agitated to make sure of even distribution of the cellular elements. Stain is drawn to the mark .1 in an ordinary leucocyte pipette, and then spinal fluid to mark 11. This is mixed and the pipette laid aside for twenty to thirty minutes. It is then shaken thoroughly (two minutes); the first two drops rejected and the third mounted in the counting chamber. After a few minutes, the entire field is counted with an 8 millimeter lens. A 4 millimeter lens cannot be used, and a 16 millimeter lens does not give a sufficient magnification. Two preparations are counted, and if these vary greatly a third. The number of cells in one slide multiplied by $\frac{101}{320}$ gives the number of cells in 1 cubic millimeter. Simple calculation will show that dividing the number in one slide by 3 is usually within 1 to 2 cells of the more accurate mensuration.

Using the 8 millimeter lens allows differentiation in the counting chamber. Small and large lymphocytes, polymorphonuclear leucocytes, plasma cells and cells of the endothelial series are usually readily differentiated.

It is true that for thorough differentiation of cells and for a complete comparative study of the cellular elements, the methods of Alzheimer or Donald should be used. Henderson and Muirhead[7] have used Alzheimer's method, cutting frozen sections with success. Klien[12] has partially reported cell studies by the sedimentation method.

But for practical clinical purposes we feel that the Fuchs-Rosenthal method is decidedly the best quantitative method. It would, however, seem desirable to use some better qualitative method in conjunction with it.

3. *Globulin Tests.* — According to Cornell[1] the earliest test used for clinical purposes was performed with saturated solutions of magnesium sulphate. This has been entirely replaced by ammonium sulphate. Phase I of Nonne[20] consists of mixing

equal parts of a solution of ammonium sulphate, saturated by heat and allowed to cool, and spinal fluid. A normal fluid will show no change, while a pathological fluid will show opalescence or marked turbidity within three minutes.

Fully as delicate and more easily read is the ring test of Ross and Jones.[22] In this, 1 cubic centimeter of spinal fluid is carefully floated on 2 cubic centimeters of a supersaturated solution of ammonium sulphate. A thin gray plate (hair-line) occurring within three minutes is a sign of excess globulin. As a rule, the plate forms immediately. Occasionally it forms after an hour or more. Such delayed tests are of doubtful significance. (The majority of negative fluids will show a little flocculent precipitate near the junction line in twelve to twenty-four hours. This is of no significance so far as I have studied it.)

Noguchi[19] introduced the butyric acid test carrying his name. Boil .2 cubic centimeter of spinal fluid with 1.0 cubic centimeter of a 10 per cent. solution of butyric acid in .9 per cent. sodium chloride solution; add .2 cubic centimeter of 4 per cent. sodium hydrate solution and boil again. Fluids containing a considerable excess of globulin will show a precipitate in a very short time, while others may require one to two hours for it to develop. The results are read at the end of two hours. A flocculent precipitate is evidence of globulin excess; if there is only opalescence without precipitate, the result is recorded as negative.

Kaplan[10] introduced a test combining butyric acid and ammonium sulphate and designed to give an estimate of the quantity of globulin in the fluid. The technique is as follows: heat .5 cubic centimeter of spinal fluid until it boils up twice; add 3 drops of a 5 per cent. solution of butyric acid in normal saline and flow .5 cubic centimeter of a supersaturated solution of ammonium sulphate under the fluid in order to obtain a contact zone. An excess of globulin is manifested by a thick, granular, pot-cheese-like ring. "If no granular thick ring forms, the fluid may be regarded as normal." If the ring is found, then 4 tubes receive .1, .2, .3 and .4 cubic centimeter of spinal fluid respectively; the amount is made up to .5 cubic centimeter with distilled water and the procedure of the first tube followed. Read at the end of twenty minutes.

The Kaplan test was in use for a time, but for more than a year the Noguchi and Ross-Jones tests have been used for determination of globulin excess.

4. *Albumen.* — Myerson[18] introduced to American literature

the Mestrezat test for albumen. The test as performed in this laboratory has been slightly modified in the direction of greater precision.

The smallest tubes are picked out of a lot of 1 by 6 centimeter tubes. Those in which 1 cubic centimeter of water rises 18 to 20 millimeters are kept aside for the albumen test. (It would be an advantage if these were flat bottomed, which mine are not.) In one of these tubes, heat 2 cubic centimeters of spinal fluid just short of the boiling point (at this point many pathological fluids become cloudy) and add .2 cubic centimeter of a 33⅓ per cent. solution of trichloracetic acid. There is some ebullition and the fluid becomes opalescent to a varying extent. In a short time a flocculent precipitate begins to form. At the end of two hours, when the reading is made, the precipitate will usually be firmly packed in the bottom of the tube. A normal fluid will show not over $\frac{1}{10}$ of the height of the column to be made up of precipitate.

5. *Colloidal Gold Test.* — In the three years since Lange[13] introduced this test, a relatively voluminous literature has grown up, and the test has firmly established itself as a standard. It is delicate, and, within limits, differential.

The theoretical basis for its application lies in the work of Zsigmondy (*cf.* Lange[13]) who showed that albuminous bodies + electrolyte + colloidal gold causes a clumping of colloidal particles and various changes in color and even precipitation. If the albumens are less concentrated, then a protective action is exerted which prevents precipitation. The point at which protection ceases varies with different albumens.

Lange applied the test to spinal fluid after experimenting with sera. He found that if he reduced the salt content to .4 per cent., holding the globulins and nucleoproteids in solution, he obtained certain changes in cerebrospinal fluid of paretics, tabetics and cases of cerebrospinal syphilis. He also found that other nervous affections either gave no reaction or else the reaction was in a different zone. The reaction in paresis he regarded as pathognomonic, that in tabes and cerebrospinal syphilis as definitely syphilitic, but not pathognomonic.

The most difficult part of the test is the preparation of the gold reagent. Various slight modifications have been proposed from time to time. The procedure outlined below is the one which has best served this laboratory, and is in the main the method outlined by Weston, Darling and Newcomb.[29]

The variations from this method (all of which have been tried in this laboratory) are also noted. The important thing to remember is that no method will give absolutely uniform results, for reasons which I am unable to state.

Utensils: Jena beaker of 1,000 cubic centimeters capacity; all glass distilling apparatus (use a plain cork to stopper the distillation flask) with no rubber in contact with steam or water; Jena flasks for stock solutions; small Jena glass beakers; accurate 5 cubic centimeter pipettes. This glassware (as well as that used in setting up the tests, and for spinal fluid examinations in general) should be cleaned in nitrohydrochloric acid, followed by thorough washing in freshly distilled water, boiling in distilled water, rinsing with double-distilled water and drying in hot-air sterilizer. The flasks and beakers may with advantage be steamed according to the method outlined in Cohen's Physical Chemistry. The glassware must be absolutely clean.

Materials: Gold chloride, c.p. (Merck), 1 per cent. stock solution in double-distilled water. Potassium carbonate, c.p. (Baker's analyzed), 2 per cent. solution made at time of using in fresh double-distilled water. Formalin (Baker's analyzed); stock solution in double-distilled water, 1 per cent. (it does not seem necessary to have the content 1 per cent. of formaldehyde; a mixture of 1 cubic centimeter of the formalin solution and 99 cubic centimeters of water is used). Stock solution of 10 per cent. sodium chloride, c.p., in double-distilled water.

Fresh double-distilled water: The water still in this laboratory is all metal. Freshly distilled water is then redistilled in glass. (The Allihn type of condenser is the best of those tried.) The water must be used on the same day it is distilled for the second time. At times it seems that a third distillation might be in order.

To make the reagent, take 500 cubic centimeters of fresh double-distilled water. Heat over a double Bunsen burner or small gas stove to approximately 60° C.; add rapidly 5 cubic centimeters of the 1 per cent. gold solution and 5 cubic centimeters of the 2 per cent. potassium carbonate solution. Heat rapidly to 90° C.; turn off the flame, and add rapidly, drop by drop, while agitating the solution, the 1 per cent. formalin solution. *Stop adding the formalin when the reagent is of the proper color.* This should not take more than 5 cubic centimeters of the formalin solution, and usually takes less.

The reagent should be a dark red, clear by both reflected and transmitted light, should have a slight blue hue at the edges, and should have not more than a trace of golden shimmer by reflected light. Purple, light blue, dark brown, or light yellow murky fluids should be discarded.

It is not always possible to secure a perfect reagent, but, within certain limits, variations in the reagent are permissible, provided only that such variations are noted and their significance known. Thus there may be some turbidity, chiefly yellowish, and the reagent be not perfectly transparent. Minor variations in the red color are also permissible, but light red reagents should never be used.

The method outlined above or any of those given below will procure good reagents the major portion of the time, but we have not been able by any method to produce a perfect reagent or even a usable reagent at every trial. Visits to other laboratories have shown that they have the same trouble. One defect in the published reports on the use of the Gold Sol is that the factor of variation in response due to minor variation in the character of the reagent has received practically no attention. This is a freely admitted defect in the present report.

Variations in technique: Grulee and Moody[6] first add gold and carbonate, heat until the first steam bubbles appear, add 5 cubic centimeters of 1 per cent. formalin solution and shake vigorously.

Jaeger and Goldstein[8] also follow this, which is the original Lange technique. They use water which has been three times distilled. Kaplan[9, 10, 11] adds the potassium carbonate to the water, heats one minute, adds 5 cubic centimeters gold and heats until the first bubbles appear. At first he used 3.75 cubic centimeters of 1 per cent. formalin, but later recommended the use of 5 cubic centimeters of .75 per cent. formaldehyde (from the context it is not clear whether this is .75 per cent. formaldehyde or formalin solution). This is added gradually with constant shaking. Flesch[4] follows Lange, using water, three times distilled. Lee and Hinton[14] pointed out that by the original technique it was difficult to obtain a series of good reagents. They add the gold and potassium carbonate at 60° C. and heat until the small bubbles arising throughout the fluid disappear (one to two minutes boiling). They then add 5 cubic centimeters of 1 per cent. formalin solution and shake vigorously. Weston, Darling and Newcomb heat to 60° C., then add the gold and potassium carbonate, then heat to 90° C. Add slowly and with constant agitation 5 cubic centimeters of solution having 1 per cent. formaldehyde content.

All agree that the reagents must be of the highest purity, the water fresh and pure; the glassware absolutely clean. Any of the methods gives good results; though Glaser[5] is frankly critical and does not believe the test yields information of sufficient value to repay one for the time and materials used on the test.

To test Apparatus — Test Tubes: Clean test tubes, of good glass, 1.5 by 12 centimeters. Test-tube racks with ten holes in a row. One cubic centimeter pipettes graduated in .01 cubic centimeter; 10 cubic centimeter pipettes graduated in .1 cubic centimeter. Jena beakers.

The 10 per cent. NaCl stock solution is diluted with fresh double-distilled water to .4 per cent. strength. Ten tubes are set up. In the first place 1.8 cubic centimeters of the salt solution, in each of the others 1 cubic centimeter. Add .2 cubic centimeter of spinal fluid to the first tube, mix thoroughly and transfer 1 cubic centimeter to the second tube; mix thoroughly and transfer 1 cubic centimeter to the third tube, and so on through the series of 10 tubes. Throw away 1 cubic centimeter from the last tube. Now add 5 cubic centimeters of the gold reagent to each tube, mix thoroughly and set aside. Indications of the reaction may be seen in a short time, but the readings are best made in twelve to twenty-four hours. The color changes are usually given as follows: 1 = red-blue and blue-red; 2 = purple; 3 = blue and violet; 4 = steel gray or blue gray; 5 = clear, with a bluish sediment at the bottom of the tube.

A paretic fluid will usually give a reaction somewhat as follows: 55555 43100.

This is what Kaplan has called the step-ladder curve. In tabes the reaction varies. It may be similar to the paretic curve (these are often cases of tabo-paresis): the reaction may take place in the first five tubes, but none be completely decolorized, or the first one or two tubes may be unchanged and the next two or three completely decolorized. A critical survey of the literature convinces me that cerebrospinal syphilis cases react in much the same way. That is, the gold reaction does not sharply differentiate between paresis, tabes and cerebrospinal syphilis in a certain proportion of cases.

The first five tubes constitute the so-called syphilitic zone. In cases of brain tumor when there is any reaction, it is usually in the third, fourth, fifth and sixth tubes, with maximum in fourth and fifth. Since we have had no experience with tuberculous and purulent meningitis, it is only necessary to state that the reaction is said to occur in still higher dilutions.

As will be seen by a glance at the tables, not every case gives a "5" reaction. Our standard here has been that if there was a change of "3" or more in three or more tubes the test was positive. If no tube showed a change as high as three, the test was considered negative. If only one or two tubes showed a considerable change, the test was repeated in order to rule out technical error.

A great many non-paretic cases will show changes of "1" or "2" in some tubes. While such tests are negative, a question arises concerning their interpretation. They may, of course, be an expression of the "gold number" for the particular protein in that spinal fluid, as has been suggested, but to my mind they are better explained by variations of minor degree in the reagent. This explanation seems to me to be borne out by our experience in repeated tests of the same sample of fluid with different gold reagents. Thus we have found that a fluid giving a minor grade of reaction with one reagent would give none with a slightly better one.

The following table includes all cases reported on in the paper: —

TABLE I. — *Results of Cerebrospinal Fluid Tests.*

GENERAL PARESIS.

Case No.	Sex.	Wass. R.		Alb.	Globulin.			Cells.	Gold.	Remarks.
		Bl.	Fl.		Kap.	Nog.	R.-J.		12345 678910	
18097	F.	p.	p.	–	p.	–	–	225	44443 32200	
18089	M.	p.	p.	–	p.	–	–	155	45554 44310	
18128	M.	p.	d.	–	p.	–	–	150	55555 55210	
18142	M.	p.	p.	–	p.	–	–	95	55555 55511	
18140	F.	p.	p.	–	p.	–	–	64	00045 55400	
18168	F.	p.	p.	–	p.	–	–	69	55555 53100	
18169	F.	d.	p.	–	–	–	–	26	33322 22000	Blood.
18160	F.	d.	p.	–	p.	–	–	15	55555 53200	
18165	M.	p.	p.	–	p.	–	–	10	23454 42000	
17560	M.	d.	p.	–	p.	–	–	90	11553 30000	
18185	M.	p.	p.	–	p.	–	–	71	55553 30000	
18087	M.	n.	p.	–	p.	–	p.	105	45555 31000	
18200	M.	n.	p.	–	p.	–	p.	60	55555 55310	
18244	M.	n.p.	p.	–	p.	–	p.	60	55555 55410	
18271	M.	d.	p.	–	–	–	p.	56	55555 44000	
18258	M.	p.	p.	–	–	–	p.	21	55555 53000	
18310	M.	d.	p.	–	p.	–	p.	25	55555 55300	
17550	F.	0	p.	–	p.	–	p.	–	55555 55320	Post mortem.
16555	M.	0	p.	p.	p.	–	p.	–	55555 55300	Post mortem.
16691	M.	p.	p.	p.	p.	–	p.	40	55555 55422	
18340	F.	0	p.*	p.	–	–	p.	–	55555 54440	
15589	F.	p.	p.	n.	n.	–	p.	9	00234 32100	
16454	M.	p.	p.	p.	p.	–	p.	22	01233 32200	
18382	M.	p.	p.	p.	p.	–	p.	37	54444 44200	
18391	M.	p.	p.	p.	p.	–	p.	15	45555 55544	
18434	M.	p.	p.	p.	–	p.	p.	30	11333 30000	
16564	M.	d.d.d.	p.	p.	–	p.	p.	60	02333 21000	
17878	F.	p.	p.	d.	–	n.	p.	122	13331 10000	
13526	F.	p.	d.	p.	–	p.	p.	–	33344 33200	
18463	M.	p.	p.	p.	–	p.	p.	220	00334 44200	
18501	M.	p.	p.	p.	–	p.	p.	50	12133 43100	
18503	M.	p.	p.	p.	–	p.	p.	28	15454 55310	
14556	F.	p.	p.	p.	–	p.	p.	14	35344 42100	

* Cholesterin antigen only: post mortem.

TABLE I. — *Results of Cerebrospinal Fluid Tests* — Continued.

GENERAL PARESIS — *Continued.*

Case No.	Sex.	Wass. R.		Alb.	Globulin.			Cells.	Gold.	Remarks.
		Bl.	Fl.		Kap.	Nog.	R.-J.		12345 678910	
18522	M.	p.	p.	p.	–	p.	p.	70	55555 32100	
18492	M.	p.	p.	p.	–	p.	p.	18	55444 44310	
18514	M.	p.	p.	p.	–	p.	p.	224	12233 21000	Rare red cell.
18524	M.	p.	p.	p.	–	p.	p.	62	10233 31000	
18529	M.	p.	p.	p.	–	p.	p.	86	55555 43100	
18539	M.	p.	p.	p.	–	p.	p.	126	11133 11000	2d "strong positive."
18562	M.	p.	p.	p.	–	p.	p.	35	55555 43000	Twice.
18586	M.	p.	p.	p.	–	p.	p.	34	45555 55410	
18591	F.	p.	p.	p.	–	p.	p.	70	55555 53130	Few red cells.
18587	M.	p.	p.	p.	–	p.	p.	40	55553 34310	Rare red cell.
18615	M.	p.	p.	p.	–	n.	p.	40	55555 55531	25 red cells.
18604	M.	p.	p.	p.	–	p.	p.	34	55555 55531	
18623	F.	p.	p.	p.	–	p.	p.	40	55555 54200	
18651	F.	p.	p.	p.	–	p.	p.	27	55555 55420	
18650	M.	p.	p.	p.	–	p.	p.	150	55555 55542	1,000 red cells.
18655	F.	d.d.	p.	p.	–	p.	p.	32	55555 54doo	d-0 to 1.
18661	M.	p.	p.	p.	–	p.	p.	7	55554 21000	
18605	M.	p.	p.	p.	–	p.	p.	227	44345 32100	
18679	M.	p.	p.	p.	–	p.	p.	185	55555 55554	
18699	M.	n.	p.	p.	–	p.	p.	393	55555 55555	
18717	F.	d.	d.	p.	–	p.	p.	71	44433 33311	
18737	F.	p.	p.	p.	–	p.	p.	147	55555 55533	
18767	M.	p.	p.	p.	–	p.	p.	120	25434 00000	Blood.
18800	F.	p.	d.	–	–	–	–	–	55555 55542	Bloody.
18804	F.	p.	p.	p.	–	p.	p.	55	55555 55432	
18799	F.	p.	p.	p.	–	p.	p.	8	55555 54300	
18808	M.	p.	p.	p.	–	p.	p.	85	55555 53210	
18785	M.	p.	p.d.	p.	–	p.	p.	82	55555 43211	
18817	M.	p.	p.	p.	–	p.	p.	48	55555 55321	
18784	M.	n.	d.p.d.	–	–	p.	p.	109	55554 31100	
18866	M.	p.	p.	p.	–	p.	p.	45	55555 33200	
18846	F.	p.	p.	p.	–	p.	p.	3–4	55554 32000	
18949	M.	d.d.d.d.	d.d.	p.	–	p.	p.	52	55555 532d0	
18946	M.	d.	p.	p.	–	p.	p.	–	55555 5432d	
18987	M.	p.	p.	p.	–	p.	p.	93	55555 55210	

TABLE I. — *Results of Cerebrospinal Fluid Tests* — Continued.

GENERAL PARESIS — *Concluded.*

Case No.	Sex.	WASS. R.		Alb.	GLOBULIN.			Cells.	GOLD.	Remarks.
		Bl.	Fl.		Kap.	Nog.	R.-J.		12345 678910	
19048	M.	p.	p.	p.	–	p.	p.	30	45555 55432	8,000 red cells.
19021	M.	p.	p.	p.	–	p.	p.	37	55555 42d00	
19000	M.	p.	n.p.	p.	–	p.	p.	109	55555 43100	Few red cells.
19070	M.	p.	p.	p.	–	p.	p.	60	23354 31000	
19091	F.	p.	p.	p.	–	p.	p.	55	55555 55521	Numerous red cells.
19087	F.	p.	p.	p.	–	p.	p.	17	55555 33d00	Few red cells.
19075	M.	d.p.	n.	n.	–	p.	p.	25	54553 10000	
18223	M.	p.	p.	–	p.	–	p.	15	22222 20300	
18146	F.	p.	p.	–	p.	–	p.	37	22340 00000	
18527	M.	p.	p.	p.	–	p.	p.	20	00032 21000	
18115	M.	p.	p.	–	p.	–	–	80	00000 00000	
18861	M.	p.	p.	n.	–	p.	p.	14	5331d 00000	
19046	F.	p.	p.	d.	–	n.	n.	3–4	00011 d0000	Few red cells.
19004	M.	p.	p.	p.	–	p.	p.	78	55555 5542d	
18583	M.	p.	p.	p.	–	p.	p.	46	55555 54300	
18966	M.	n.p.	p.	p.	–	p.	p.	78	45555 32doo	
Three cases in which changes in gold were not set down on card.										
18417	M.	p.	p.	p.	p.	–	p.	59	"Weak Positive."	
15781	M.	p.	p.	p.	p.	–	p.	30	"Positive."	
18549	M.	p.	p.	p.	–	p.	p.	206	"Positive."	
TABO-PARESIS.										
18453	M.	p.	p.	p.	–	–	p.	22	55544 41000	
18565	F.	p.	p.	p.	–	p.	p.	84	55555 55200	
18621	M.	p.	p.	p.	–	p.	p.	70	55555 32100	
18607	M.	p.	p.	p.	–	p.	p.	70	55555 55420	
18882	M.	d.n.	p.	p.	–	p.	p.	12	55555 55322	
19027	M.	p.p.	d.p.	p.	–	p.	p.	21	55555 53100	
18319	M.	d.d.	p.	p.	n.	–	p.	74	02254 33100 04445 44000 00031 00000	Good illustration of variation in reaction according to reagent.
18177	M.	d.	n.	–	p.	–	n.	8	44552 00000	
		d.	n.	–	p.	–	p.	11	35554 40000	
17859	M.	p.	d.	gold and W. R. only					33333 20000	
			Spinal, post mortem						45555 442dd	
			Base, post mortem						55555 54220	Slightly bloody.

TABLE I. — *Results of Cerebrospinal Fluid Tests* — Continued.

TABES.

Case No.	Sex.	Wass. R.		Alb.	Globulin.			Cells.	Gold.	Remarks.
		Bl.	Fl.		Kap.	Nog.	R.-J.		12345 678910	
16111	F.	n.	n.	p.	–	p.	p.	60	1333 10000	
TABES OR SPINAL SYPHILIS.										
18523	F.	p.	p.	p.	–	p.	p.	435	22244 32000	Rare red cell.
PARESIS OR CEREBRAL SYPHILIS.										
18701	F.	p.	p.	p.	–	p.	p.	110	55533 32200	1,000 red cells.
19018	M.	p.	d.	p.	–	p.	p.	–	55555 5533d	6,000 red cells.
			n.	p.	–	p.	p.	204	55555 5532d	Few red cells.
PARESIS CASES WITH MORE THAN ONE TEST.										
16277	M.	p.	p.	p.	n.	–	p.	9–10	11233 10000	
									12221 00000	
18408	M.	p.	p.	n.	n.	–	n.	3–4	00001 10000	
									00112 11000	
18355	M.	p.	p.	p.	p.	–	p.	30	00033 33000	Previous to salvarsan intraspinously the gold was typical.
									00055 54000	
									00033 10000	
18349	M.	p.	p.	p.	p.	–	p.	30	44555 40450	Shows well the variation in reagents.
									04445 54400	
									00003 31000	
18111	F.	d.p.	p.	–	p.	–	p.	20	44443 33000	
		p.	p.	p.	–	p.	p.	–	00020 21000	Red cells. Treated.
18321	M.	p.	u.	n.	–	n.	n.	–	00002 02000	Few red cells.
			p.	p.	–	–	p.	25	00134 42100	
18502	M.	n.	n.	n.	–	n.	n.	12	00024 33000	
			n.	p.	–	p.	p.	3–5	00000 00000	
			n.	p.	–	n.	n.	1	00000 00000	
18674	M.	p.	p.	p.	–	p.	p.	59	01233 21000	
									00000 00000	
			Second fluid — gold only						00000 00000	
18224	M.	p.	d.	–	p.	–	–	75	50114 40000	Error in technique.
			p.	–	p.	–	p.	120	55555 52000	
18444	M.	d.	d.	p.	–	p.	p.	148	45555 52200	
			d.	p.	–	p.	p.	112	55534 44210	
			d.	p.	–	p.	p.	141	50250 40300	Red cells. Error.
18575	F.	p.	p.	p.	–	p.	p.	36	44444 00000	
			p.	p.	–	p.	p.	93	14432 10000	Remission.
17355	M.	p.	p.	p.	–	p.	p.	90	55543 21000	
			p.	p.	–	p.	p.	84	55555 53100	Remission.

TABLE I. — *Results of Cerebrospinal Fluid Tests* — Continued.

PARESIS CASES WITH MORE THAN ONE TEST — *Concluded.*

Case No.	Sex.	WASS. R.		Alb.	GLOBULIN.			Cells.	GOLD.	Remarks.
		Bl.	Fl.		Kap.	Nog.	R.-J.		12345 678910	
18681	M.	p.p.	d.	p.	–	p.	p.	18	55555 55521	
			p.	p.	–	p.	p.	28	55555 55300	
18815	F.	p.	p.	p.	–	p.	p.	86	55554 32000	
			p.	p.	–	p.	p.	113	25454 42100	
18930	M.	d.p.d.p.	d.	p.	–	d.	p.	105	01333 21000	
			p.	p.	–	p.	p.	208	55222 10000	7,000 red cells.
19001	M.	n.p.	i.	p.	–	p.	p.	82	55004 02200	
			p.	p.	–	p.	p.	–	55555 5431d	Post mortem.
		Fluid from base, post mortem							55555 5532d	Slightly bloody
19050	M.	p.p.	u.	p.	–	p.	p.	429	55555 5431d	
			n.	p.	–	p.	p.	200	55555 55553	Few red cells.
			p.	p.	–	p.	p.	220	01555 53d00	
18850	M.	n.p.	p.	p.	–	p.	p.	10	55555 30000	
			p.	p.	–	p.	p.	27	55555 53322	
18452	M.	p.	d.p.	p.	–	p.	p.	78	45555 32doo	
		Fluid from lumbar, post mortem							54535 44100	
		Fluid from base, port mortem							55535 53200	
18552	M.	p.	p.	p.	–	p.	p.	100	20002 22000	1,000 red cells.
		Fluid from lumbar, post mortem							55555 5522d	

ARTERIOSCLEROTIC INSANITY.

Case No.	Sex.	WASS. R.		Alb.	GLOBULIN.			Cells.	GOLD.	Remarks.
		Bl.	Fl.		Kap.	Nog.	R.-J.		12345 678910	
18212	M.	p.	n.	–	p.	–	p.	20	33333 00000	Many red cells.
18218	M.	p.	n.	–	n.	–	n.	0	00223 30000	
18377	M.	p.	n.	p.	–	–	n.	–	00000 00000	
17831	M.	n.	n.	p.	–	–	n.	–	00000 00000	Post mortem.
18267	M.	n.	n.	n.	n.	–	n.	–	00000 00000	2 bloody specimens.
18272	F.	p.	n.	–	n.	–	n.	4–5	00011 10000	Few red cells.
18252	M.	n.	n.	–	p.	–	p.	–	00000 00000	Blood. Post mortem.
14077	M.	n.	n.	–	n.	–	n.	–	00020 00000	
17453	M.	n.	n.	–	n.	–	n.	–	00000 00000	2 post mortem.
18375	M.	n.	n.	–	n.	–	n.	0–1	00111 00000	
18608	F.	n.	n.	–	n.	–	n.	1	00010 00000	
18858	M.	n.	n.	n.	–	n.	n.	2–3	00022 21000	
18876	M.	n.	n.	n.	–	n.	n.	0–1	11000 00000	
18793	F.	n.	n.	p.	–	p.	p.	3–4	11233 32100	Few red cells.

TABLE I. — *Results of Cerebrospinal Fluid Tests* — Continued.

CASES WITH SEVERAL TESTS.

Case No.	Sex.	WASS. R.		Alb.	GLOBULIN.			Cells.	GOLD.	Remarks.
		Bl.	Fl.		Kap.	Nog.	R.-J.		12345 678910	
18104	M.	n.	n.	–	n.	–	–	8		
			n.	–	n.	–	–	7	11333 44411	Due to use of too delicate reagent.
			n.	n.	–	n.	n.	3–5	00010 00000	
			n.	–	–	–	n.	2–3	0dd10 00000	
18119	M.	p.	n.	–	p.	–	–	–	00000 00000	Red cells.
			n.	–	n.	–	–	97	32200 00023	
			n.	–	–	–	n.	27	02100 00000	
18646	F.	p.	d.	p.	–	p.	p.	4–5	d1123 455dd	Bloody.
		p.	d.	p.	–	p.	p.	3–4	11232 10000	Red cells.
		d.	d.	p.	–	n.	n.	4	ddd22 2dd00	
ALCOHOLICS.										
18229	M.	n.n.	n.	–	n.	–	n.	–	00333 20000	Numerous red cells.
18456	M.	p.	n.	n.	–	n.	n.	3	00000 00000	
18109	F.	d.	n.	–	p.	–	–	2	00000 00000	
18176	M.	d.	n.	–	n.	–	–	3	00200 00000	
18249	M.	n.	n.	–	n.	–	n.	3	00000 00000	
18226	M.	n.	n.	–	n.	–	n.	2	00000 00000	Post mortem.
18399	M.	n.	n.	n.	n.	–	n.	–	00000 00000	
18374	F.	p.	n.	n.	n.	–	n.	2	00122 21100	
13360	M.	n.	n.	n.	n.	–	n.	4	00121 11110	
18393	M.	d.d.	n.	n.	n.	–	n.	1	00000 00000	
18440	M.	n.	n.	n.	n.	–	n.	0	00001 10000	
18494	M.	n.	n.	n.	n.	–	n.	1	00001 00000	Few red cells.
18675	F.	n.	n.	n.	–	n.	n.	1	00120 00000	
18721	M.	n.n.	n.	n.	–	n.	n.	4–5	00011 11000	
18319	M.	d.d.	p.	n.	–	n.	n.	3	22220 00000	
18781	F.	p.	n.	n.	–	n.	n.	3	00012 00000	
18754	M.	d.d.d.	u.n.u.	n.	–	n.	n.	2	00221 00000	
18868	M.	n.	n.	n.	–	n.	n.	1	00122 10000	
18855	M.	p.p.	n.	n.	–	n.	n.	2	00000 00000	
18874	M.	d.p.d.p.	n.	n.	–	n.	n.	1	00011 10000	
18827	M.	n.	n.	n.	–	n.	n.	3	00000 00000	
18926	F.	n.	n.	n.	–	n.	n.	2	00dd0 00000	
18915	M.	p.d.p.	n.	p.	–	p.	n.	15	ooddo 00000	
				p.	–	n.	d.	10	02222 d0000	
19044	M.	p.p.	n.	n.	–	n.	n.	–	0dd31 d0000	
				–	–	n.	n.	–	11110 00000	
17465	M.	n.	–	–	–	p.	p.	–	30011 d0000	Post mortem.
									00000 00000	Error in technique.
18381	M.	n.	n.	n.	–	n.	n.	4	00000 00000	Alcoholic epilepsy.

TABLE I. — *Results of Cerebrospinal Fluid Tests* — Continued.

MANIC-DEPRESSIVE.

Case No.	Sex.	WASS. R.		Alb.	GLOBULIN.			Cells.	GOLD.	Remarks.
		Bl.	Fl.		Kap.	Nog.	R.-J.		12345 678910	
18046	F.	d.d.	n.	–	n.	–	–	–	00000 00000	
18081	M.	d.	n.	–	n.	–	–	0	00000 00000	
18138	F.	d.d.	n.	–	n.	–	–	4	00000 00000	
18025	F.	d.	n.	–	d.	–	–	1	00000 00000	
18285	M.	n.	n.	–	n.	–	–	5	00000 00000	
18333	F.	n.	n.	p.	–	–	n.	–	00000 00000	Post mortem.
17803	F.	n.	n.	n.	–	n.	n.	30	00000 12100	Post mortem.
18136	F.	n.	n.	n.	–	n.	n.	0	00000 00000	
18394	F.	p.	n.	n.	–	n.	n.	3	00000 00000	40 red cells.
16295	F.	–	n.	n.	–	n.	n.	0	01222 10000	
18373	F.	p.	n.n.	n.	–	n.	n.	5	00000 00000	
16793	F.	–	n.	n.	–	n.	n.	1	00000 00000	
16356	M.	n.	d.	–	n.	–	–	6	01233 33220	
		–	n.	n.	–	n.	n.	–	00000 00000	2 golds same.
DEMENTIA PRÆCOX.										
18103	F.	n.	n.	–	n.	–	–	3	00000 00000	
18091	M.	d.	n.	–	n.	–	–	9	00010 00000	
18090	M.	n.	n.	–	n.	–	–	3	00111 00000	Red cells.
18191	F.	d.d.n.	n.	–	n.	–	–	0	00000 00000	
12463	F.	–	n.	p.	–	–	p.	–	00000 00000	Post mortem.
17562	M.	–	n.	p.	–	–	p.	–	00000 00000	Red cells.
18415	M.	n.	n.	n.	–	n.	n.	0	00111 00000	
10169	F.	p.	n.	n.	–	n.	n.	0	00000 00000	
11065	F.	p.	n.	n.	–	n.	n.	3	00000 00000	
11108	F.	n.	n.	n.	–	n.	n.	–	00000 00000	2 golds same.
17178	F.	p.	n.	n.	–	n.	n.	0	00000 00000	
13937	M.	n.	n.	n.	–	n.	n.	3	00000 00000	
14610	F.	–	n.	n.	–	n.	n.	3	01122 00000	
17671	M.	p.	n.	n.	–	n.	n.	–	00000 00000	Red cells.
16981	F.	n.	n.	n.	–	p.	n.	–	00000 00000	
18757	F.	n.	n.	n.	–	n.	n.	1	11110 00000	
18776	M.	p.p.	n.	n.	–	d.	d.	17	00000 00000	
18996	M.	p.	n.	n.	–	n.	n.	4	00000 00000	
13347	M.	n.	n.n.	p.	–	d.	–	2	12333 10000	

TABLE I. — *Results of Cerebrospinal Fluid Tests* — Continued.

DEMENTIA PRÆCOX — *Concluded.*

Case No.	Sex.	Wass. R.		Alb.	Globulin.			Cells.	Gold.	Remarks.
		Bl.	Fl.		Kap.	Nog.	R.-J.		12345 678910	
18499	M.	d.p.	p.	n.	–	n.	n.	72	01121 00000	Developing cerebral syphilis.
		–	p.	–	–	n.	n.	57	22211 00000	
									13343 10000	
									12333 10000	
		–	d.	n.	–	n.	n.	27	23211 00000	
		–	–	–	–	p.	p.	55	23333 20000	
18520	M.	p.d.	p.	n.	–	n.	n.	2	00000 00000	
		–	n.	n.	–	n.	n.	–	00000 00000	
		–	n.	n.	–	n.	n.	1	00011 11000	
18117	M.	d.	n.	–	n.	–	–	0	00000 00000	
18306	F.	p.p.	n.	n.	–	n.	n.	0	00011 00000	
18642	F.	p.	n.	–	–	–	–	–	33234 2d000	Bloody.
		–	–	n.	–	n.	n.	–	22220 00000	

DEFECTIVES.

Case No.	Sex.	Bl.	Fl.	Alb.	Kap.	Nog.	R.-J.	Cells.	Gold.	Remarks.
18269	M.	n.	n.	–	n.	–	–	–	00000 00000	Red cells.
14722	M.	p.	n.	n.	n.	–	n.	2	00001 10000	
18454	F.	n.	n.	n.	–	n.	n.	0	00000 00000	
18551	M.	n.	n.	n.	–	n.	n.	4	00012 11000	
18629	F.	n.	n.	n.	–	n.	n.	3	00000 00000	
18816	M.	n.	n.	n.	–	n.	n.	2	01110 00000	
19090	M.	n.	n.	–	–	–	–	–	000dd 11000	Post mortem.

EPILEPTICS.

Case No.	Sex.	Bl.	Fl.	Alb.	Kap.	Nog.	R.-J.	Cells.	Gold.	Remarks.
18682	M.	n.	n.	n.	–	n.	n.	1	01232 11000	
15689	M.	n.	n.	–	n.	–	–	4	00000 00000	
18384	M.	n.	n.	n.	–	n.	n.	–	01111 00000	Red cells.
18992	F.	d.	n.	p.	–	p.	–	3	00121 dd000	Numerous red cells.
18928	F.	n.	n.	n.	–	n.	n.	0	00dd0 00000	Few red cells.

DRUGS.

Case No.	Sex.	Bl.	Fl.	Alb.	Kap.	Nog.	R.-J.	Cells.	Gold.	Remarks.
18203	F.	p.	p.	–	n.	–	–	9	44441 00000	
18358	F.	p.	d.n.	n.	–	n.	n.	8	00000 00000	2 golds same.
18821	F.	p.p.	n.	–	–	–	–	3	11333 00000	Bloody.
19019	F.	p.	n.	n.	–	n.	n.	2	00dd0 00000	
18944	M.	p.p.p.	n.	p.	–	n.	n.	3	00000 00000	

TABLE I. — *Results of Cerebrospinal Fluid Tests* — Concluded.

UNCLASSED.

Case No.	Sex.	WASS. R.		Alb.	GLOBULIN.			Cells.	GOLD.	Remarks.
		Bl.	Fl.		Kap.	Nog.	R.-J.		12345 678910	
15795	M.	–	n.	–	n.	–	–	0	00000 00000	
18219	M.	n.	n.	–	n.	–	n.	4	00000 00000	
14043	M.	n.	n.	n.	–	n.	n.	2	00000 00000	2 golds same.
18407	F.	n.	n.	n.	–	n.	p.	–	00dd0 00000	Red cells.
18469	M.	n.n.	n.	n.	–	n.	n.	2	00000 00000	
18705	F.	p.	n.	n.	–	n.	n.	6	11110 00000	
18829	F.	p.	n.	p.	–	p.	p.	1	00122 10000	Few red cells.
19078	M.	n.	n.	p.	–	n.	d.	4	00d11 d0000	
18820	F.	p. –	n. n.	p. p.	– –	p. n.	p. p.	2 6	11233 32000 00022 20000	Red cells.

UNCLASSED ORGANIC DISEASE.

Case No.	Sex.	Bl.	Fl.	Alb.	Kap.	Nog.	R.-J.	Cells.	Gold.	Remarks.
16456	M.	n.	n.	p.	p.	–	–	26	55555 55432	Paretic?
18386	F.	n.	n.	p.	–	p.	p.	27	32554 31000	Multiple sclerosis.
18030	F.	n.	n.	–	n.	–	n.	–	00000 00000	Post mortem.
18526	F.	n.n.	n.	d.	–	n.	n.	3	01110 00000	
18884	M.	n.	n.	n.	–	n.	n.	1	00012 00000	
17342	F.	n.	n.	p.	–	n.	n.	6	dd122 1d000	
15027	F.	n.	n.	n.	–	n.	n.	13	00000 00000	2 golds same. Few red cells.
18047	F.	n.	n.	–	n.	–	n.	5	02100 00000	

MISCELLANEOUS.

Case No.	Sex.	Bl.	Fl.	Alb.	Kap.	Nog.	R.-J.	Cells.	Gold.	Remarks.
18457	M.	n.	n.	–	–	–	–	–	01111 22100	Bloody. Acromegaly.
19053	F.	n.	n.	n.	–	n.	n.	0	00122 2d000	Few reds. S.D.
18038	M.	n.	n.	–	p.	–	–	2	00133 21000	Infection-exhaustion.
18266	M.	d.	n.	–	n.	–	n.	3	00000 00000	Pernicious anæmia.
18791	M.	p.	n.			Bloody			44532 20000	Trauma.
18199	M.	d.	n.	–	n.	–	n.	7	00020 00000	Trauma.

RESULTS OF TESTS.

All of the data are presented in Table I, where the cases are grouped according to the clinical diagnoses. There are altogether 240 cases, of which number 120 fall into the general group of brain syphilis. Of these, 9 are cases of tabo-paresis; 1 a case of tabes; 3 are cases in which diagnosis between paresis, tabes or cerebrospinal syphilis is uncertain; the remaining 107 are cases of paresis.

In this section the tests are dealt with individually.

1. *The Wassermann Test.* — Tables II and III are constructed from the data given in Table I. Table II gives a general survey of the blood and spinal fluid findings in the various groups. In Table III these are further analyzed, the fluid findings being arranged according to the blood findings in each group.

In a previous paper[15] I have presented the statistics from a series of 1,600 patients admitted to this hospital on whom the Wassermann reaction was used as a routine. In the group of 145 paretics there considered, the blood test was positive in 87.5 per cent. and negative in 10.3 per cent. The spinal fluid was positive in 87.2 per cent. of 111 cases tested and negative in 8.5 per cent. The test was positive in both fluids in 75 per cent. of cases. Data were presented on 145 paretics. (See also Morse.[17])

In the group of 120 here reported (in part the same as the above) the blood Wassermann reaction is positive in 81.8 per cent.; negative in 6 per cent. (116 cases with blood test); the fluid Wassermann reaction is positive in 90 per cent. and negative in 4.1 per cent. (120 cases of fluid test), while the test is positive in both in 77.5 per cent. (116 cases with tests in both). These figures are based on the number of cases with tests in each fluid. There is a somewhat higher percentage of doubtful results in the group here reported.

TABLE II. — *Results of the Wassermann Test on Blood and Fluid.*

PSYCHOSIS.	No. Cases.	BLOOD WASSERMANN.				FLUID WASSERMANN.			
		Positive.	Doubtful.	Negative.	None.	Positive.	Doubtful.	Negative.	None.
Neurosyphilis, . .	120	96*	13	7	4	108†	7	5	1
Arteriosclerosis, . .	17	6	–	11	–	–	1	16	–
Alcoholic, . . .	26	7	5	14	–	1	–	24	–
Manic-depressive, . .	13	2	4	5	2	–	1	12	–
Dementia præcox, . .	24	9	3	9	3	–	1‡	23§	–
Defectives, . . .	7	1	–	6	–	–	–	7	–
Unclassed, . . .	9	3	–	5	1	–	–	9	–
Unclassed organic, .	8	–	–	8	–	–	–	8	–
Drugs, ...	5	5	–	–	–	1	1	3	–
Epilepsy, . . .	5	–	1	4	–	–	–	5	–
Miscellaneous, . .	6	1	2	3	–	–	–	6	–
Totals, . . .	240	130	28	72	10	110	11	118	1

* Including 4 cases with negative and positive tests.

† One case cholesterin reinforced antigen only.

‡ Twice positive; once doubtful.

§ One case once positive; three times negative.

This table includes all cases, those tested post mortem as well as ante mortem.

There are only 2 cases in this group in which both blood and fluid are negative to the Wassermann reaction.

2. *Cell Counts.* — Among the cases of brain syphilis counts of 3 to 4 per cubic millimeter have occurred in 4 cases. The next lowest count is 6, and the highest is 435.

In 127 counts on the fluids from the 120 cases of brain syphilis, counts of 10 or below occurred in 13 cases: 11 to 25 in 20; 26 to 50 in 26; 51 to 100 in 38; 101 to 250 in 27; over 250 in 3. In other words, 97 gave counts of less than 100, and 30 counts over 100.

TABLE III. — *Further Analysis of Combination of Tests in Blood and Fluid.*

BLOOD WASSERMANN REACTION POSITIVE.

	No. Cases.	FLUID WASSERMANN REACTION.			
		+	±	—	°
Neurosyphilis,	96	90	4	2	-
Arteriosclerosis,	6	-	1	5	-
Alcoholic,	7	-	-	7	-
Manic-depressive,	2	-	-	2	-
Dementia præcox,	9	-	1	8	-
Defectives,	1	-	-	1	-
Unclassed,	3	-	-	3	-
Drugs,	5	1	1	3	-
Miscellaneous,	1	-	-	1	-

BLOOD WASSERMANN REACTION DOUBTFUL.

	No. Cases.	+	±	—	°
Neurosyphilis,	13	9	3	1	-
Alcohol,	5	1	-	4	-
Manic-depressive,	4	-	-	4	-
Dementia præcox,	3	-	-	3	-
Epilepsy,	1	-	-	1	-
Miscellaneous,	2	-	-	2	-

TABLE III. — *Further Analysis of Combination of Tests in Blood and Fluid* — Concluded.

BLOOD WASSERMANN REACTION NEGATIVE.

	No. Cases	FLUID WASSERMANN REACTION.			
		+	±	—	°
Neurosyphilis,	7	5	–	2	–
Arteriosclerosis,	11	–	–	11	–
Alcoholic,	14	–	–	13	1
Manic-depressive,	5	–	1	4	–
Dementia præcox,	9	–	–	9*	–
Defectives,	6	–	–	6	–
Unclassed,	5	–	–	5	–
Unclassed organic,	8	–	–	8	–
Epilepsy,	4	–	–	4	–
Miscellaneous,	3	–	–	3	–

NO BLOOD WASSERMANN REACTION.

	No. Cases	+	±	—	°
Neurosyphilis,	4	4†	–	–	–
Manic-depressive,	2	–	–	2	–
Unclassed,	1	–	–	1	–
Dementia præcox,	3	–	–	3	–

* 1 case + once, 3 times.

† 1 case reinforced antigen only.

It has been known for some time that the cell count is not necessarily of diagnostic or prognostic value. Thus the old dictum that counts over 100 cells were indicative of cerebrospinal lues as distinguished from paresis and tabes has been abandoned. Mitchell, Darling and Newcomb[16] and latterly Solomon[27] have shown how the cell count may vary in both untreated and treated cases of paresis. The former found very wide variations in the count from time to time, from 260 at one time to 0 at another in the same untreated case. In 31 of 34 cases they found counts less than 3 at some time.

Solomon concludes that the number of cells offers no definite information of prognostic value and that one cannot differentiate cerebrospinal syphilis or general paresis on the basis of the cell count. Further, he states that the cell count is not an index of the predominance of irritative or degenerative changes.

Counts above 5 per cubic millimeter occurred in this series in the following cases other than cerebrospinal syphilis: 3 arteriosclerotics; 1 alcoholic; 1 manic-depressive case (post mortem); 3 unclassed organic and 1 traumatic. Nearly all of these cases had positive blood Wassermann tests.

In the majority of my cases, no special attempt has been made to do accurate differential counts. This is to be regretted.

Cotton and Ayer[2] and many others have shown the value of the differential count, and especial stress is laid on the plasma cell. Plasma cells were not found in any non-luetic psychosis, but were noted (not carefully searched for) in about one-half of the syphilis group.

3. *Globulin Tests.* — (*A.*) Kaplan test: In 36 tests on 34 cases of the syphilitic group, the test was negative in 4. In the other 32 tests on 30 cases it was positive in some dilution. On fluids from non-specific cases it was positive in 5 of 47 tests. Of these 5, 2 may be ruled out because of blood in the fluid, leaving 3 tests in 45 positive. Three times blood was demonstrated microscopically and the test was negative.

(*B*) Noguchi test: A positive result was obtained in 74 out of 80 syphilitic cases tested. In 13 of these the test was twice positive. In 4 cases the test was negative; in 1 doubtful and positive and in 1 negative, positive and again negative at different examinations. In 5 cases the result may have been influenced by the blood present.

Used 86 times on 70 fluids from non-syphilitic cases, the test was negative in 56 cases (in 2 were traces of blood). In 6 it was positive (3 bloody fluids, 1 post mortem); in 2 it was doubtful. The repeated tests were: (1) 2 bloody fluids positive, a third negative; (2) 3 negative, 1 positive (cerebral syphilis developing); (3) 3 negative; (4) 2 negative; (5) and (6) bloody positive and negative.

It seems evident that, with a blood free fluid, the test is very reliable, and that doubtful tests are very rarely obtained.

(*C*) Ross-Jones test: Used in 106 syphilitic cases, it was positive in 101 (90 on one test; 9 on two tests; 2 on three tests). In 2 it was negative. In 2 it was first negative, then positive, while in 1 it was negative, positive and again negative. In 10 cases the positive result may have been influenced by the blood present.

Used in 86 cases not diagnosed as neurosyphilis it was positive in 9 (of which 6 were bloody and 2 were obtained post mortem); negative in 75 (4 with blood; 2 twice and 2 thrice negative; 1 twice positive (bloody) and once negative; 1 doubtful and negative; 1 thrice negative and once positive); and doubtful in 2.

If we rule out the cases examined post mortem and those with bloody fluids, we find only 1 case with positive test. The test is, therefore, very reliable.

4. *Albumen Test.* — This test was used in 94 cases of neurosyphilis with the following results: positive in 86 (blood present in 6; thrice positive in 2; twice positive in 6; bloody fluid positive, and later positive without blood in 2); negative and positive in 2; negative in 4; doubtful in 2.

No definite conclusions can be drawn from the amount of excess. In general, the positive cases showed about double the normal amount.

The test was used on 84 non-syphilitic cases, with a positive result in 16, doubtful in 1, and negative in the others. In general, the excess was slight and occurred, as a rule, in those cases with some organic lesion.

This result bears out Myerson's contention that albumen increase is an undifferentiated response to injury.

5. *The Gold Test.* — As stated above, a test is regarded as in some sense positive when 3 or more tubes show a color change to "3" or more. The syphilitic zone is the first five tubes. The tests are here analyzed both according to clinical groups and intensity of reaction.

(*A*) Paresis: single tests, 84 cases. Type reaction: 5–5–5–5–5–4–3–1–0–0.

Analysis of the data in Table I shows the following: —

	Cases.
First 5 tubes decolorized — "5,"	41
First 5 tubes change to "4" and "5,"	11
First 5 tubes change to "3," "4" and "5,"	7
	59

That is, 59 of the 84 cases show changes of a positive order in all of the first 5 tubes.

For the entire group, the changes in each tube may be summarized as follows: —

TUBE NO.	COLOR CHANGE.						
	5.	4.	3.	2.	1.	0.	*d.*
1, ...	51	9	3	5	8	8	0
2, ...	57	5	6	5	4	7	0
3, ...	55	7	11	5	2	4	0
4, ...	58	8	13	2	2	1	0
5, ...	49	14	13	3	2	2	1
6, ...	38	13	19	6	3	4	1
7, ...	26	2	15	11	9	11	0
8, ...	10	9	14	13	10	24	4
9, ...	2	4	6	7	13	51	1
10, ...	1	2	1	5	7	66	2

Further analysis of Table I shows that in 10 of these 84 cases, the reaction was decidedly atypical. These, with reaction, were —

18140,	00045	55400
15589,	00234	32100
16454,	01233+	+32200
18463,	—334	44200
18501,	12133	43100
18524,	10233+	31000
18527,	00032	21000
18115,	00000	00000
19046,	00011	±0000
18223,	22222	20300

In all of these there were other evidences of abnormality in the fluid to corroborate the diagnosis.

Removing the 59 and 10 cases, we have remaining 15 cases which gave neither absolutely typical nor decidedly atypical reactions.

Therefore it seems that in about 10 per cent. of our cases with a single test, an atypical reaction is obtained. Probably most of these, on further testing, would have given a positive reaction.

(*B*) Tabo-paresis: six cases. All gave a strongly positive test, typical for paresis.

(*C*) Other neurosyphilis cases: Tabes, 1; tabes or spinal syphilis, 1; paresis or cerebral syphilis, 1. These were all positive in the syphilitic zone, though of varying intensity.

(*D*) Paresis cases with more than 1 test. The majority of these cases were tested ante mortem only. Four of these gave essentially negative results. One of these showed a slight reaction in the syphilitic zone, while the other 3 showed slight reactions in one test, but none in others. The remaining 17 all gave positive reactions on one or more tests.

No. 18355 illustrates one point remarkably well. This man had received intensive salvarsan treatment without clinical improvement. Previous to the treatment the gold had been typical, but in this table a great change had been effected.

No. 18349 gives a very good illustration of variation in results according to reagent. All 3 tests were made the same day on the same sample of fluid with 3 different batches of reagent, varying from normal to a clear, very dark red.

Three cases were tested both ante mortem and post mortem, with essentially the same results except in 1, where a much more intense reaction was secured post mortem.

(*E*) Other neurosyphilis cases with repeated tests: Case No. 18319 further emphasizes the varying results with different reagents. Case No. 17859 is of interest because of the much more intense reaction obtained from the cerebral fluid, as compared with the spinal.

(*F*) Non-syphilitic cases: Four of these cases appear to have a syphilitic basis. These are 18499 (diagnosis dementia præcox), an hallucinated, fearful case with high cell count and a weak gold reaction in the syphilitic zone: 16456, a case of 11 years' duration, clinically paresis with spastic paraplegia, with a positive gold but negative Wassermann; and 18386, a case of multiple sclerosis, with negative Wassermann, positive gold (no response to antisyphilitic treatment); 18203, a drug habitué with serological findings of paresis.

Aside from these, no positive reactions are found (according to our criteria), except in certain bloody fluids, or where there has been previous hemorrhage. A certain number of cases show minor grades of change, at times in the syphilitic zone. In many of these cases we are certain that the reagent is at fault; in others, the reason is obscure.

None of these cases gives a reaction at all comparable to the typical paretic curve, though some of our paretic cases give results somewhat comparable to the non-paretic results.

Discussion.

The results of the Wassermann test, the proteid tests and the cytological results have been sufficiently discussed above. There remains only the gold reaction.

The finding of certain slight color changes in a few tubes in non-syphilitic cases is in accord with the general experience. In fact, Flesch[4] states that if *no* change is the criterion of the normal fluid, then the fluid is normal in only about 50 per cent. of normal individuals. As previously pointed out, and substantiated by certain observations, we believe that in a certain proportion of cases this is due to slight defects in the reagent.

With regard to the syphilitic cases, results of various observers differ somewhat. Thus Solomon and Koefod[23] show that paresis gives very typical reactions, but a case of undoubted paresis may give atypical reactions, and cases not paresis may give the type reaction. (Here, again, there is the possibility of minor grades of reagent variation.) Solomon, Koefod and Welles[26] reporting on 500 cases, believe the test is of value in the differentiation of paresis, cerebrospinal syphilis and tabes; that syphilitic cases do not react out of the syphilitic zone, though non-syphilitic cases may react within the zone. (See also Solomon and Welles.[25])

Jaeger and Goldstein[8] state that, in paresis and cerebrospinal syphilis, they obtain a strong characteristic precipitation in 100 per cent. of cases.

Kaplan[9, 10, 11] finds a characteristic curve for all cases of paresis and some of tabo-paresis, but does not think the test is specific for neurosyphilis.

Weston, Darling and Newcomb[29] find the test positive in all cases of paresis.

I find about 10 per cent. of decidedly atypical results, and about 10 per cent. of intermediate, with 80 per cent. fairly typical, in cases of paresis and tabo-paresis. To be sure, there are one or two of our cases diagnosed paresis in which there might be considerable doubt of the diagnosis, but these do not greatly affect the percentages. It is certain that, with Danvers criteria of diagnosis, the reaction is not typical for paresis in more than 90 per cent. of our paretic cases, although some sort of reaction in the syphilitic zone is found in a rather higher percentage. We have had no strong reactions in this zone without other evidence of abnormality in the spinal fluid.

In our experience, not only the Gold Sol (see Solomon and Welles[24]) but also the Wassermann reaction are entirely reliable post mortem. We do find, however, regular evidence of increase of albumen in these post-mortem fluids, which seems to be without diagnostic significance.

As a general rule, in both syphilitic and non-syphilitic cases, the gold reaction and the Wassermann reaction are closely parallel. Exceptional cases will give one reaction negative and the other positive. These may usually be cleared up by repeated tests. However, it may safely be stated that a positive, typical gold reaction is of almost as much value alone as supported by a Wassermann test. This in view of our experience that in only 2 cases was a negative Wassermann obtained where the gold was strongly positive, and in both of these the other tests corroborated the gold results.

In fact, as a general statement, it is very easy to show a fairly close parallelism between protein excess, pleocytosis, gold and

Wassermann reaction, although one or more of these may be negative in a given fluid, without seriously altering the interpretation. It is extremely unsafe to draw conclusions from fluids in which a single test is positive, and all others negative. In such cases a second test should always be done. Especially is it unsafe to diagnose neurosyphilis on the basis of a positive Wassermann in the spinal fluid, all the other tests being negative.

It is as yet uncertain which test first becomes positive in the development of neurosyphilis. Probably this varies. But until more is known, it is unsafe to base a diagnosis on a partial examination of the fluid. I have elsewhere reported (this series) a case in which an erroneous diagnosis was made on insufficient evidence of this sort.

A positive gold with all other tests negative has not occurred in my series. If it did occur, I should attach considerable weight to it, but in my opinion, no single test in the spinal fluid is enough to establish the etiology of an organic brain disease. The Wassermann test, protein tests, cell count and Gold Sol test should all be done on every fluid which is examined. It is the sum of the results of these tests which should decide.

SUMMARY.

1. Data are presented covering the spinal fluid tests on the cerebrospinal fluids from 240 cases of mental disease, of which 120 were diagnosed as neurosyphilis.
2. Various methods of performing each test, protein excess, cell count and gold reaction are described, together with a statement of methods now in use.
3. Of 130 positive blood Wassermann tests, 96 occurred in cases of neurosyphilis. The test was negative in 7 of 120 cases of neurosyphilis.
4. Of 110 positive fluid Wassermann tests, 108 occurred in cases of neurosyphilis. Five of 120 neurosyphilis cases gave negative tests. One alcoholic case and one drug case gave positive tests in the fluid. Both of these will probably develop paresis.
5. Ninety cases, or 75 per cent. of neurosyphilis, gave positive tests in both fluid and blood. One drug case gave positive tests in both.
6. In 127 counts on the fluids from 120 cases of neurosyphilis, counts below 10 occurred 13 times; 11 to 50, 6 times; 51 to 100, 38 times; above 100 in 30.

7. Counts above 5 per cubic millimeter occurred in 3 arteriosclerotics, 1 alcoholic, 1 manic-depressive (post mortem), 3 unclassed organic and 1 traumatic.

8. Excluding bloody fluids, and possibly fluids with old hemorrhages, the globulin tests (Noguchi and Ross-Jones) are (*a*) positive in practically all syphilitic and (*b*) negative in practically all non-syphilitic cases.

9. The occurrence of slight excesses of albumen in non-syphilitic organic cases apparently bears out Myerson's contention that the albumen increase is an undifferentiated response.

10. Typically positive gold tests were found in 80+ per cent. of paresis and tabo-paresis cases.

11. Atypical positive gold tests were found in 10 per cent. of cases; with decidedly atypical tests in the remaining 10 per cent. cases.

12. "Positive" gold tests were not found in cases without syphilis, except in old hemorrhage cases.

13. There is close parallelism in the results of all tests considered together.

14. Variations in gold reaction may be due to minor variations in the character of the reagent. These must always be considered.

15. Done under proper conditions and correctly interpreted, the gold reaction is of immense value.

16. It is the sum of the results of all reactions, and not the result of one, which is of value in diagnosis.

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REPORT OF A BRAIN TUMOR IN A CASE CLINICALLY CONSIDERED TO BE PARESIS.

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This case is reported because of the rarity of brain tumors among the insane; because of the unusual location of the tumor, and because of the erroneous diagnosis of paresis made in this instance.

The case is that of a male, clinical No. 17643, pathological No. 1764. An illiterate French-Canadian, with onset of mental trouble at forty-one. The family history is negative for nervous and mental diseases and cancer. Patient, a blacksmith; Catholic; married, six children. Married life happy. Naturally quiet. Slight drinker. Never intoxicated. Never arrested. No history of trauma or serious illness. Psychosis: from 1911 to time of admission in October, 1913, at age of forty-three, gradually failed. Did not work in this period. Said to have had a "shock" in 1912, following which he was unconscious for two to three minutes. Following this he had an unconscious spell lasting three to five minutes about once a month. For some months speech somewhat thick and indistinct. Never irritable. Became somewhat restless at night, untidy, and memory gradually failed. Never expressed any delusions. For two weeks was very weak and had to be cared for in bed. Complained of pains in head and again all over body. No venereal history obtained.

Physical Examination. — Height, 5 feet, 6 inches. Weight, 136¼ pounds. Hair gray. Sallow complexion. Mucous membranes pale. Tongue tremulous. Facial asymmetry. High and narrow palate. Lungs negative. Heart normal except that sounds are distant. Pulse, 82. Moderate thickening of peripheral vessels. Blood pressure, 135. Abdomen negative. Wassermann on blood serum positive, on spinal fluid unsatisfactory. Fluid contained blood, hence other laboratory tests unreliable.

Complained of no pain or headache. Eye movements normal. Arcus senilis. Pupils irregular, unequal, react sluggishly to light and distance (equal impairment in reactions). Vision not determined. Co-operated poorly in sensibility tests, so that little was made out. No tenderness of large nerve trunks. Could not recognize objects "due to dementia."

Knee jerks absent. Arm reflexes normal. Cremasteric and abdominal reflexes absent. Incontinent. Sways in Romberg's position. Marked tremor of fingers and tongue. Slept a great part of the time.

Mental Examination. — Dull and stupid. Remained quietly in bed.

Contented. Untidy. No spontaneous speech. Responses relevant and coherent. Some motor speech defect. Knew the month, but not the year. In a hospital but did not know where. School knowledge practically nil. No evidence of hallucinations. Memory much impaired. No tendency to fabricate. Could not be made to understand the association tests. Expressed no delusions. No insight. Thought he was sick, but mind all right. Indifferent.

Oct. 28, 1913: Quiet, dull, stupid, physical condition poor. November 1: Quiet, dull, stupid, demented, speech defect, untidy. November 4: Brighter and more responsive, disoriented, memory impaired. November 12: No delusions. Disoriented for place and partially for time. Contented. November 14: Presented at staff meeting with a diagnosis of general paresis, to which all agreed. December: Difficulty in walking. Falls out of bed. Staggering gait. Headache and toothache. Eyesight dull. No delusions or hallucinations. January, 1914: Convulsions, not serious. Failing. February: Quiet, failing, no relevant responses. August: Demented. Excited and angry at times. Marked expectoration. Spoon fed. Oct. 9, 1914: Gradually failed for two weeks. Had a series of convulsions from which he did not rally, and died.

Autopsy.—One and a half hours post mortem. Contractures at hips and knees. Atrophy of calves. Trochanteric and sacral decubitus. Bloody blebs and discoloration and maceration of the skin of the left hand. Pupils unequal. Axes of the eyes directed outward. Pyorrhea. Abdominal organs in good position. Adhesive pleuritis. Broncho-pneumonia. Slight fibrosis of heart muscle. Fatty liver. Diffuse nephritis. Small colloid cyst in thyroid. Head, calvarium not thickened. Somewhat dense in frontal region. Dura not thickened; not adherent to calvarium or pia. Pia arachnoid not perceptibly thickened anywhere. Considerable quantity of fluid in the sub-arachnoid spaces. Basal vessels not sclerotic. Pituitary small and flat; sella turcica shallow. Brain weight, 1,560 grams, Pons and cerebellum 180 grams. Floor of the fourth ventricle shows a faint granular ependymitis. Cerebellum slightly softer than normal. Sections negative.

Hemispheres: each temporal pole fluctuant. Tuber cinereum bulging and dark in color. Just in front of the anterior extremity of the corpus callosum there is, in the left hemisphere, a white, firm, raised area, of irregular shape. This is firmer than the surrounding tissue, is whiter than the gyri, but has much the physical characteristics of a gyrus. Median sagittal section reveals a large irregular grayish mass, containing numerous soft, reddish hemorrhagic areas. This has invaded the corpus callosum and both thalami. To a large extent it fills up the third ventricle, and it more or less blocks up the lateral ventricles as well — filling thus all of the aperture below the corpus callosum (*cf.* Figs. 1 and 2). The ventricles contain bloody fluid, and show a marked granular ependymitis. The irregular mass noted on the median aspect of the left hemisphere is apparently not connected with the larger and deeper mass.

The brain was hardened without further sectioning in 10 per cent. formalin, and after one month was photographed in external view, both before and after stripping the pia. Frontal sections were then made. The left hemisphere was longer, deeper and narrower than the right. The left lateral ventricle was larger than the right in cross section — that is, there was unequal internal hydrocephalus. Tumor mass larger on right than on left. In certain areas, as just above the thalamus, the entire right ventricle was filled by it. Where it invaded the ventricular walls, it was of looser texture. Corpus callosum much corroded. On the right side, a whitish mass arising behind the thalamus extends for a short distance on the median surface of the hemisphere. Descending horn of left lateral ventricle contains a large blood clot in addition to bloody fluid. Gyrus dentatus poorly marked on left side. Tumor mass gray, lobulated and contains numerous hemorrhagic points of varying size. Above the posterior horn of the lateral ventricles, the white matter is soft.

Figs. 1 to 3 give a good idea of the extent and relations of the tumor. It is apparently one arising in the third and lateral ventricles but just where, it is impossible to say.

Microscopical examination of the body organs confirms the diagnosis made for them. Examination of the cortex and spinal cord *fails to reveal any evidence of a paretic process.* There is no perivascular exudation, no serious disturbance of the cytoarchitectonic picture, no great changes in the nerve cells. There is apparently a certain paucity of nerve cells, with some increase in the neuroglia, but such changes are notoriously hard to judge. There are a great many cells, presenting themselves as long drawn out rods, with a nucleus located somewhere near the middle. Apparently there is a slight increase in the number of small vessels. The cells for the most part stain deeply and more or less homogeneously, but there is no evidence of grave alterations. No satellitosis. These statements are based on the examination of sections from the following areas, all stained with cresyl-violet: frontal, precentral, postcentral, temporal, calcarine, gyrus dentatus, lenticular nucleus and thalamus of each hemisphere, three levels of the cord and Gasserian ganglion. With phosphotungstic acid hematoxylin, the cortex appears to have an unusually dense network of neuroglia fibrils. Various areas of the tumor were examined in sections stained by the following methods: cresyl-violet, Weigert's iron hematoxylin and picro-fuchsin, phosphotungstic acid hematoxylin, Weigert and Marchi. The tumor is a very cellular one, at some points being almost purely cells. Intermingled with the cells there is a varying proportion of fibers, which stain blue with phosphotungstic hematoxylin and pale green with picro-fuchsin. The cytoplasm of the cells is for the most part faintly stained, but where the outlines of a cell can be definitely made out, it is found to be angular, and in close connection with the fibrils. The nuclei are well preserved. For the most part they stain palely, with well-marked chromatin granules and intranuclear network. Their shape varies. Some are oblong; these are more deeply stained:

while the remainder are oval or irregular, and larger than the oblong. In certain sections the nuclei are aggregated into a sort of rosette formation. In some areas the cells are very closely packed and there are almost no fibers. A few large cells appear to be full of vacuoles. There are numerous capillaries with occasional hemorrhagic and necrotic areas.

The tumor is evidently a glioma, arising probably in the third ventricle, and extending into the surrounding structures. It attained, in the course of three years, a relatively large size, and invaded a number of important parts. It is very striking that a tumor invading such important structures should have produced so few symptoms. The chief symptoms were the gradual decline of energy, memory and attention, and the cardinal signs of brain tumor were never present to a striking degree. The correlation between symptoms and lesion in this case is almost impossible.

Discussion. — Tumors are of relatively rare occurrence in brains of the insane; thus, there have been but 26 instances of brain tumor in 1,860 Danvers autopsies. Blackburn[1] was able to report but 29 cases among 1,642 autopsies in 1903.

Intraventricular tumors are apparently rather rare. Thus, Starr[2] presents (Table XIII) statistics on the location of brain tumors in 600 cases. This table shows that 61 tumors, or 10 per cent., were found in the basal ganglia and lateral ventricles. Of these 61 tumors, 17 were tuberculous and 1 was gummatous, leaving 43 tumors which might be regarded as independent of infections. He further states (page 594) that only 20 cases of tumor of the corpus callosum had been reported up to 1913. To these may be added a case reported by Iaracoff.[3]

Weisenburg[4] in 1910 reported 30 cases of tumor of the third ventricle; 3 of his own and 27 obtained by careful survey of the literature. Of these, 3 simulated paresis clinically. Two of these were reported by Mott and Barratt[5], who state that the resemblance to paresis was superficial. One of the cases was regarded as an epileptic and general paretic at different times. Weisenburg states that there are no specific mental symptoms for lesions of the third ventricle, but that such symptoms as occur are due to pressure on the cortex from internal hydrocephalus. The impression is that drowsiness, apathy and dull mentality (or even greater impairment) are likely to be found with such tumors. Ataxia of the cerebellar type was found in the majority of cases.

Gordon[6] in 1914 reported a case of tumor of the basal ganglia of the left hemisphere destroying the larger part of the caudate and lenticular nuclei and also the adjacent part of the optic

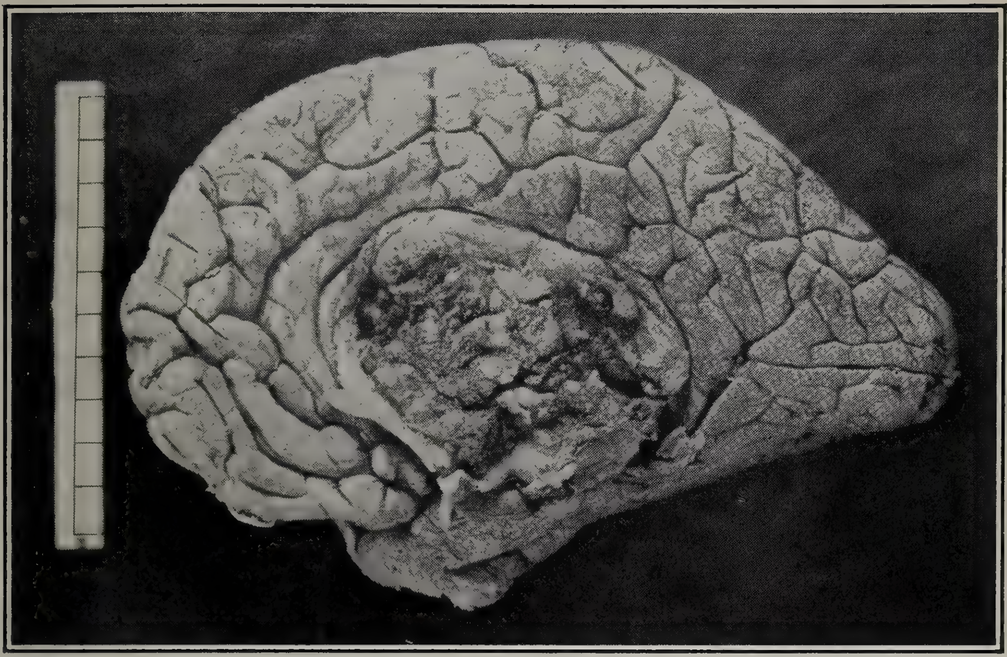


Fig. 1. — Extent and relations of tumor mass on the mesial surface of the hemisphere.

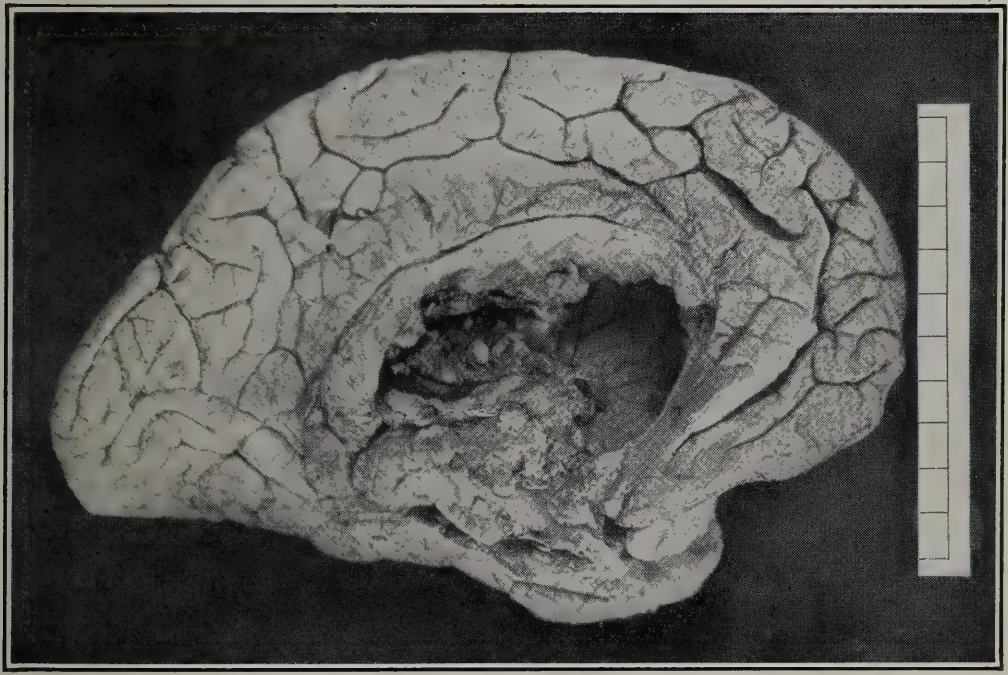
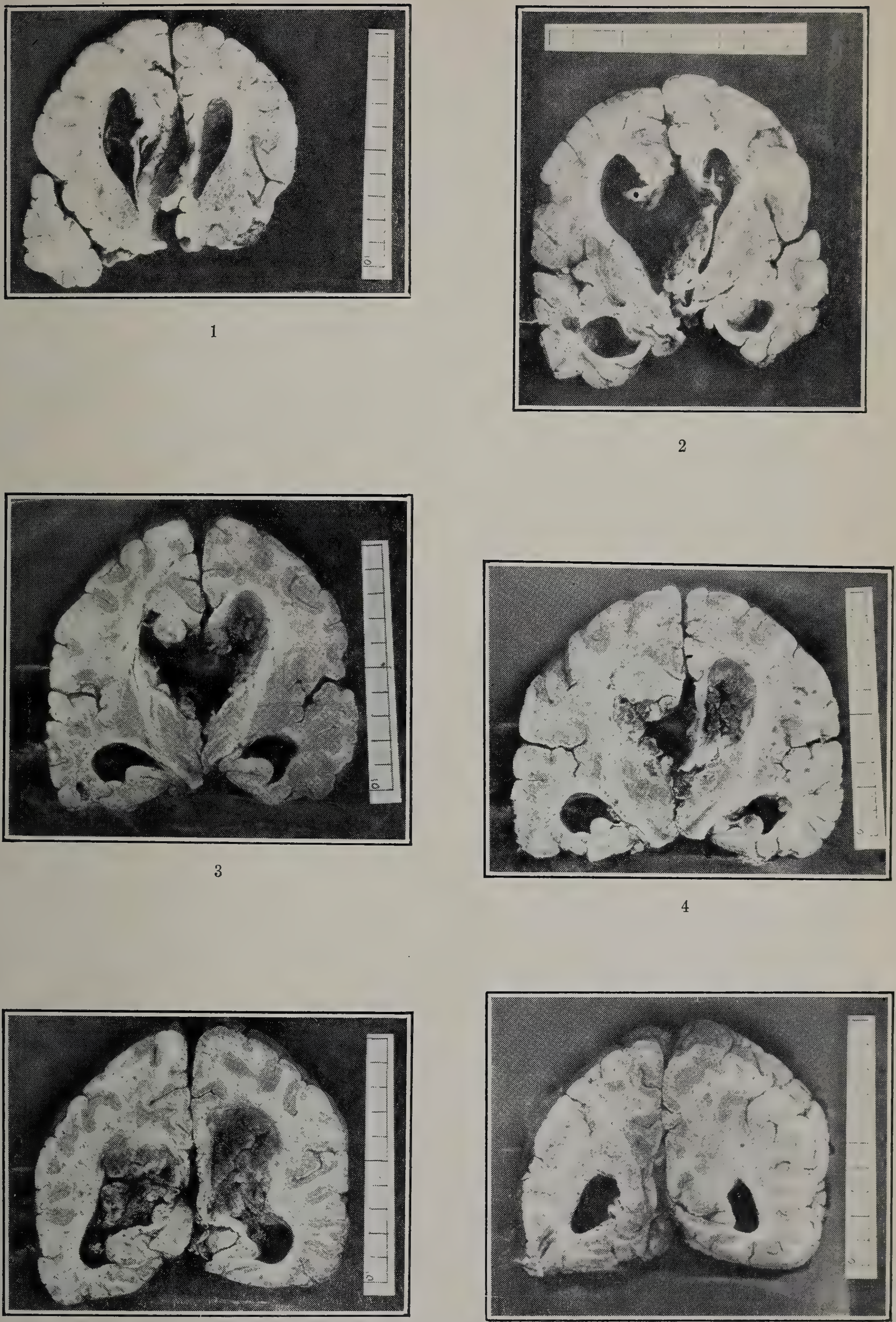


Fig. 2. — Tumor on mesial surface of the brain hemisphere.



1 2 3 4 5 6

Fig. 3. — Coronal sections to show the extent and relations of the tumor. Note the invasion of the corpus callosum and walls of the ventricles.

thalamus and extending downward to the base. The resemblance to paresis was very striking and a lumbar puncture was performed. The spinal fluid Wassermann was negative, but there was a lymphocytosis.

Pollock[7] reported a case of tumor of the third ventricle extending as a polyp through the left foramen of Monro.

One of Blackburn's cases (No. 1237) showed a tumor mass apparently originating in the region of the corpora quadrigemina and thence extensively invading the brain. It extended along the superior cerebellar peduncles and formed masses in the cerebellum: forward into the cerebral hemispheres and involved the basal region at the junction of the occipital and temporal lobes. It projected into the posterior horn of the lateral ventricle as fungoid masses and some fungoid masses extended along the lateral walls of the third ventricle. This is figured and described as a round cell sarcoma.

The exact origin of the tumor reported in this case cannot be definitely determined. It fills up most of the lateral ventricles posterior to the plane of the optic chiasm, extensively involves the corpus callosum, invades the walls of the lateral ventricle and of the third ventricle. It does not, therefore, present any specially marked similarity to any of the tumors referred to above. One may surmise that it probably originated in the third ventricle. It is, to say the least, an unusual type of ventricular tumor, since these are practically always described as being either sarcomatous or some variety of fibroma, while this is apparently a very cellular glioma, or, at best, a glio-sarcoma.

The significance of the positive blood and doubtful spinal fluid Wassermann tests is uncertain. No lesions were found which could be laid to a specific infection. The tumor is certainly not a gumma and, as explained above, there is no evidence of paresis in the sections of the cortex.

This case emphasizes again the importance of a *satisfactory* and *complete* examination of the spinal fluid in all cases in which paresis is suspected. Had the unsatisfactory examination in this case been repeated there is every reason to believe that the erroneous diagnosis would not have been made.

SUMMARY.

1. This paper presents a study of a case of glioma involving the third and posterior portion of the lateral ventricles and the corpus callosum. The case was diagnosed as paresis but no evi-

dence of paresis was found in the microscopical study of the cortex.

2. The tumor is somewhat unusual in type for its location, as tumors in this region are usually sarcomas or fibromas, while this is a glioma or at most a glio-sarcoma.

3. As in many other reported cases of tumors in this region no definite symptom complex appeared.

4. This case emphasizes the importance of satisfactory spinal fluid examinations in all cases in which paresis is suspected.

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ON THE METHOD OF RECORDING BRAIN WEIGHTS; THE ERROR DUE TO INCLUSION OF CEREBRAL FLUID.

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When one speaks of brain weights there at once arises the question of what is included in the weight. It is very easy to demonstrate differences depending upon the interval between removal and weighing, due to loss of superficial fluid from the arachnoid meshes. Some weigh with the brain a rather variable flap of the dura mater. Again, some weigh the brain from which the pia has been stripped. This last weight is undoubtedly the more correct one, but the almost universal custom is to weigh the brain with the pia-arachnoid containing a variable amount of fluid.

If the interval between the removal and weighing and the amount of cerebral fluid were always constant, there could be no particular objection to this method. But we never succeed in weighing all of the cerebral fluid, as much basal and other fluid is lost, and the amount weighed with an absolutely uniform procedure is extremely variable, as will be shown.

For the purpose of securing a standard method of procedure, giving more directly comparable brain weights than the usual practice, we began in February, 1915, the following procedure, and present herewith the data from 50 cases so handled.

Immediately upon removal the brain was weighed, with whatever fluid remained in the arachnoid. It was then allowed to drain for ten minutes. The pons and cerebellum, always removed by a transverse cut at the upper border of the pons, were weighed; then the hemispheres together.

The difference between the first weight and the sum of the two latter gives the amount of the superficial fluid; and the sum of the two latter is the "first net weight." In order to weigh the ventricular fluid, either (1) the hemispheres may be cut apart, and each drained of fluid by manipulation and weighed separately, or (2) an incision may be made into the base of each temporal lobe at the lower end of the lateral ventricle, the fluid drained off, and the hemispheres weighed together or singly.

Either of these methods will drain the ventricles with a minimum of destruction, and this is desirable, especially where any topographical work is being done. The ventricular fluid seems not so variable in amount as the superficial, and was not estimated in all cases of the series.

The data were obtained from 50 brains, 28 from male and 22 from female bodies. The cases were unselected, being a consecutive autopsy series. The age at death varied from thirty-eight to ninety-one.

The data are presented in Table I, which gives for each observation the number of cases, and the average, minimum and maximum values obtained. This table shows that not all observations were made on every case. Thus the ventricular fluid alone was weighed in only 18 cases, although determined together with the superficial fluid in 13 additional cases. Similarly, the superficial fluid was determined alone in only 37 cases, but together with the ventricular fluid, it was measured in 13 more. These variations are explainable on the basis of variations in the method of procedure due to circumstances entirely aside from the problem at hand. Any apparent discrepancies in the figures are attributable to these variations.

Table I. — *Brain Weights with and without Fluid.*

	Number of Cases.	Average (Grams).	Minimum (Grams).	Maximum (Grams).
1. Brain weight,	50	1,271	950	1,565
2. Superficial fluid,	37	35	10	85
3. Pons and cerebellum (drained),	50	157	125	205
4. Hemispheres s̄ superficial fluid,	37	1,091	860	1,355
5. First net weight,	37	1,248	985	1,530
6. Ventricular fluid,	18	23	10	35
7. Total fluid,	31	50	25	110
8. Right hemisphere s̄ fluid,	33	535	390	625
9. Left hemisphere s̄ fluid,	33	535	405	625
10. Final net weight,	31	1,216	935	1,430

Note. — In 37 cases superficial fluid estimated; in 18 cases ventricular fluid also estimated; in 31 cases both estimated (*i.e.*, 18 above plus 13 in which no intermediate weighings done).

However, the table makes obvious the fact that it is not entirely a matter of indifference how the brain is weighed. Thus the case with a first brain weight of 1,350 grams requires a new viewpoint when we subtract 110 grams for fluid and find a weight of 1,240 grams.

To be sure, we always speak of the amount of fluid in an impressionistic manner, noting an excess or absence, but these notations do not help us to a more correct analysis. Thus I find notes "excess" and "fair amount," the amount apparently greater in the first instance, applied to cases showing the same amounts by weight.

Since it appeared from our observations that the ventricular fluid was present in small and not greatly variable amounts, we now use the first part of the method, registering for each brain the following weights: gross, pons and cerebellum drained, cerebrum drained, superficial fluid and first net. This at least gives us a fairly accurate standard for comparison.

The most commonly used formula for calculating the expected brain weight in the individual is Tigge's. This formula allows 8 grams of brain for each centimeter of body length. On comparing the calculated weight of the brain for these cases with the observed gross and final net weights, at once is revealed both the defect in weights as commonly recorded and in accepting the formula as representing the actual normal.

TABLE II.

	Number of Cases.	Average (Grams).	Minimum (Grams).	Maximum (Grams).
Gross weight greater than formula, . .	15	78	13	169
Net weight greater than formula, . . .	9	60	6	134
Gross weight less than formula, . . .	13	86	16	210
Net weight less than formula, . . .	19	91	1	250

The formula, though perhaps applicable in general, is dangerous in the individual case. It is much better to use Quain's tables.

SUMMARY.

Some more uniform scheme other than the usual one of weighing the brain plus a greater or less quantity of fluid is highly desirable, at least in order to have a uniform, comparable set of figures.

A table is presented showing the great variation in the amount of superficial fluid present in the cerebral meninges. Observations on the difficulty of estimating this amount and on the wrong idea of the brain weight obtained by the ordinary methods are given. The ideal method would be to strip the brain before weighing.

A simple scheme is given whereby one may obtain the gross first net and final net weights very easily. Of these, the first net is now determined in all cases in this laboratory, and is used in all calculations. Apparently the ventricular fluid is much less variable than is the superficial.

Finally, Tigge's formula should be applied with caution, since variations in the amount of cerebral fluid retained make a considerable difference in the interpretation.

ON THE INDEXING OF CASE RECORDS. — AN ANALYSIS OF THE METHODS IN USE AT DANVERS STATE HOSPITAL.[1]

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The present methods of making and indexing case records at Danvers State Hospital have been gradually evolved. It is approximately fifteen years since the case book system, which is still in use at many hospitals, was abandoned for the loose leaf and individual case record.

Early in the use of this system the practice of making a symptom index in each case was begun. This was done by inserting a sheet bearing a printed list of symptoms of mental diseases, on which a check mark was placed opposite each symptom shown by the patient.

A card index of cases by admission number was also started. This card, called the history card, contained on one side ruled spaces for certain items there called for, while on the other was written the list of symptoms shown by the patient.

Two cross indices were then developed. The first of these was a cross index of diagnoses; the second a cross index of symptoms. Thus, under the guide-head "hallucinations" and subhead "auditory" one may find on the cards the case number of all cases in which auditory hallucinations have occurred.

At the same time the method of recording facts, and to some extent the facts themselves, has been undergoing a process of evolution.

This paper is intended to describe briefly the present methods of recording and indexing cases, since it is felt that these methods hold a great deal of value for the work of any hospital.

When a patient is admitted to the hospital a number is assigned, an outside stiff manila envelope receiving the number and name of the case. There is an "inside folder" bearing on the face the usual data of identification, — the name, number, residence, correspondent, etc. (form prescribed by the State Board of Insanity). The body of the record is typewritten according to the dictation of the physician in charge of the case.

If we open a completed record we find: (1) the abstract, written on pink sheets; (2) the family and personal history; (3) the physical and neurological examination; (4) the mental examination, in the form of a summary; (5) the ward notes (admission, three days, one week, then weekly until presentation for diagnosis, with a stenographic record of the interrogatory when presented); (6) the weight chart, (epileptic chart), (catamenial chart), consciousness and orientation form, nurse's ward notes, psychological examination forms.

These will always be found in the same order. That this uniform system makes for ease in examining any considerable number of records goes without saying, while the reduction, where possible, to definite printed forms leads to uniformity of examination.

All examinations are made according to definite schemata, which are very comprehensive. For purposes of reference, these have been brought together in a small printed folder.

From the major record the physician who presents the case prepares an abstract, which covers all of the positive (and many negative) facts in the case. This is extremely useful in obtaining a rapid review of the essentials of the case. One of the pink sheets contains a printed list of symptoms and signs (Form 2), and a checkmark is placed against each one which the patient shows.

With the determination of provisional or final diagnosis at staff meeting, the indexing of the record begins: — First of all, the "history card" is made out. The face and reverse sides of this are shown in Forms 1 and 2. The list of symptoms on the reverse side is the same as that on the pink sheet. The list printed on the face corresponds for the most part with the facts shown on the inside cover.

NAME	**ADMITTED**	**DISCHARGED**	**No.**
DIAGNOSIS			
Previous or Subsequent Number	Forms of admission	No. Commitment Transfer Voluntary	
Age	Occupation	Civil Condition	Total No. Brothers and Sisters
Nationality Father Mother.	Nativity Residence.		Consanguinity
Education	Heredity		Birth
Religion Attitude thereto	Stigmata		Birth No.
Alcohol	Previous Alienation		Age First Attack
Lues. Date	Etiology.		Puberty.
Height	Date and Manner of Onset		Menstruation
Weight	Temperament	Complexion	No. of Children and Miscarriages
Trauma	Duration of Psychosis		Age of Youngest
Cause of Death	Subsequent reports		Menopause, Age
Result	(OVER) **DANVERS STATE HOSPITAL**		

Form 1.

Decade.
Foreign born, resident.
non-resident.
Previous attack.
Remission
Race.
Racial idiosyncrasy.
Heredity.
Twins.
Environmental influences.
Poverty.
Illiterate.
Mental stress.
Change in circumstances.
Domestic infelicity.

Illegitimacy.
Immoral.
Prostitute.
Sex perversion.
Love affair.
Neurotic.
Social.
Seclusive.
Peculiar.
Always inferior.
Stigmata.
Tic.
Court record.
Police record.
Criminal traits.

Diabetes.
Glycosuria.
Nephritis.
Œdema.
Vasomotor disorders.
Albuminuria.
Renal casts.
Arcus senilis.
Arteriosclerosis.
Vertigo.
Blood pressure.
Heart disease.
Cardio-genetic.
Meningitis.
Typhoid fever.
Tuberculosis.
Other infectious diseases.
Rheumatism.
Chorea.
Pellagra.

Gastrointestinal disorders.
Anæmia.
Leukemia.
Blood smear.
Thyroid, large.
small.
Exophthalmic goiter.
Myxœdema.
Acromegaly.
Skin diseases.
Hypertrichosis.
Herpes.
Varicosities.
Jaundice.
Emaciated.
Adipose.

Alcohol.
Other drugs.
Lead poisoning.
Trauma.
Surgical operation.

Menstrual disorders.
Uterine disorders.
Menopause.
Pregnancy.
Puerperal.
Puberty.

Deaf.
Ear disease.
Headache.
Neuralgia.
Insomnia.
Incontinence.
Vomiting.
Shock.
Seizure.
Grand mal.
Petit mal.
Aura.

Hemiplegia.
Paralysis.
Anesthesia.
Hyperesthesia.
Paræsthesia.
Neuritis.
Aphasia.
Paraphasia.
Astereognosis.
Pupils unequal.
irregular.
abnormal reaction.
Ptosis.
Nystagmus.
Diplopia.
Blind.

Exophthalmus.
Optic neuritis.
Knee jerks altered.
Achilles reflex altered.
Gordon's reflex.
Oppenheim's reflex.
Clonus.
Babinski's reflex.
Romberg's sign.
Inco-ordination.
Ataxia.
Tremor.
Speech defect.

Gonorrhea.
Syphilis.
Tabes.
Wassermann blood.
c. s. fluid.
Albumen c. s. fluid.
Globulin c. s. fluid.
Coll. gold c. s. fluid.
Cell count c. s. fluid.
Plasma cells c. s. fluid.

Orientation preserved.
partial.
Disoriented.
Insight present.
partial.
absent.
Attention defect.
Memory defect.
Fabrication.
Retrospective falsification.

Dementia.
Ganser's syndrome.

Korsakoff's syndrome.
Exhaustion.
Stupor.
Confusion.
Delirium.
Dream state.

Automatism.
Blocking.
Cerea flexibilitas.
Negativism.
Mannerisms.
Stereotypy.
Schizophrenia.
Echolalia.
Echopraxia.
Incoherence.

Verbigeration.
Perseveration.
Violent.
Silly.
Mute.
Irrelevant.
Impulsive.
Untidy.
Drowsy.
Inactive.
Tube-fed.
Inordinate appetite.

Euphoria.
Exaltation.
Indifference.
Depression.
Angst.
Emotions labile.
Irritable.
Apprehensive.
Inaccessible.
Evasive.
Hypersuggestible.
Flight of ideas.
Distractibility.
Psychomotor excitement.
Motor restlessness.
Retardation.
Inadequacy.
Self-accusation.
Rhyming.
Circumstantiality.

Delusions autopsychic.
somatopsychic.
allopsychic.
grandiose.
persecutory.
systematized.
nihilistic.
unreality.
reference.
influence.
Hypochondriasis.
Obsessions.
Phobias.
Hallucinations visual.
auditory.
other types.
Illusions.

Suicidal threats.
acts.
Homicidal threats.
acts.

FORM 2.

Obviously it is necessary to have an experienced physician prepare the "pink sheet," and it requires very little more time to check the history card at the same time. With care and attention devoted to these two points, and with a good classification, the remainder of the indexing can be performed by clerks or trained patients.

From the history card the cross indices of diagnoses and symptoms can very easily be made out by clerks. There is nothing especially distinctive about these indices. They are made on plain cards the size of the history card.

Hospital records are of value in three directions: as a record of fact for family or legal purposes; as records for medical purposes; and as data for research. Probably they are on the whole least satisfactory in the latter rôle.

The methods described above yield results which are of distinct research value, and add a great deal to the value of the records from a legal and medical point of view. The cross indices in particular represent a mine of easily accessible research wealth. For the study of any large group of cases, the history card offers a quick and convenient means of surveying the main facts.

One point must be insisted on, — that all responsibility for preparing the history card should be placed on one competent man who is interested in the work, else by omission or wrong interpretation many errors may creep into the cross indices. However, if one recognizes this source of error, it is easy to check back when discrepancies occur.

U.HOL